THE

FOUNDRY TRADE JOURNAL

WITH WHICH IS INCORPORATED

THE IRON AND STEEL TRADES JOURNAL.

VOL. 34. Thursday, August 5, 1926. No. 520.

PUBLISHED WEEKLY.

Subscription Terms: 15s. per annum.
Foreign and Colonial, 17s. 6d. per annum.
All Subscriptions are payable in advance.

All communications to be addressed to the Editor, or to the Publisher, as the case may be, of

THE FOUNDRY TRADE JOURNAL,
49, WELLINGTON STREET, LONDON, W.C.2.

Telephone: Gerrard 3951 (4 lines).
Telegraphic Address:—"Zacatecas, Rand, London."

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Forthcoming Event.

SEPTEMBER 27—OCTOBER 1.

International Foundrymen's Congress and Exhibition at Detroit, U.S.A.

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

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The Metallurgical Student.

During the past few weeks a number of graduate students will have left the metallurgical departments of the Universities, and doubtless a considerable proportion of these are trying to find the best way of getting into industry. The more able student tends to be tempted to stay on to pursue research work with the help of scholarships, and there is much to be said for giving such a student a chance to carry out a piece of work entirely on his own responsibility. But before so doing he would be wise to examine the position very seriously in relation to future possibilities, and to consider how he will himself be placed at the end of such a period. There is an undoubted but strictly limited demand for highly-trained metallurgists for pure research. The men who will secure permanent employment in research work require, however, to have not only technical knowledge but a gift of scientific imagination not necessarily possessed even by the graduate student. Post-graduate research may appear better than nothing when jobs are hard to get, but is it to the lasting benefit of the average student?

In reply the student will ask what alternative he has. In the abstract it is universally agreed that there should be more scientifically trained men in industry. This is felt particularly in ironfounding, where there is a shortage of men to follow the present generation of managers. Is there, however, any definite concrete demand for graduate students in ironfounding? It must be admitted frankly that there is not. A certain number of men are required to enter industrial laboratories to assist the chemists and metallurgists in charge, but even here the demand is limited, and in any case it is doubtful whether routine analytical operations are best performed by university men. Some students, of course, will go abroad, and others already have connections in the industry. But what of the student who wants to enter the industry at home and has no existing contacts? He must realise that there is practically no place for him on the manufacturing, commercial, and managerial side of the industry merely by virtue of his special knowledge, and moreover, he frequently does himself injustice by specifying a particular salary and prospects in advance. There are no prospects in business; they are created by men as they go along, and arise largely from constant hard work, intelligence, application, and the seizing of every opportunity. But instead of adapting himself to industry, the graduate often seems to expect industry to adapt itself to him. We would recommend students to take any job that offers and make the best of it, and not to stipulate for particular conditions. If there is any virtue in superior intelligence and education it cannot fail to tell.

Where possible we would urge students to try and get some sort of practical training or apprenticeship, for practical experience is at least as important as university training, although there are unfortunately no scholarships to subsidise it other than the bursaries provided by the 1851 Commissioners. Even for the man who is fitted for and will take up research work, such practical training is desirable and will never be regretted.

The student may feel it hard that industry does not want him until he has proved on its own terms that it cannot do without him, but such is the fact. Business men engaged in the constant struggle to carry on will make use of any likely instrument they meet, but of course it must be close at hand when needed. If it happens to take the form of a promising young man he will find his training an enormous help. But in business, personality,

energy, and character count for so much that mere technical knowledge is no adequate substitute. The recent conference of metallurgical students in Birmingham indicated that these facts are being appreciated by some, at least, of those most intimately concerned.

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Electrically Melting Cast Iron.

To the Editor of The Foundry Trade Journal.

Sir,—In your issue of July 15 you published a Paper by Mr. J. R. Hyde on "Improving Cast Iron." In the course of this Paper Mr. Hyde states that it was found that between 850 and 900 electric units per ton were used to provide cast iron at a temperature round about 1,460 deg. with an arc type of electric furnace.

In the writer's opinion this statement is apt to be misleading and unfair to the electric furnace. The writer has records of a test taken on a 3-ton arc melting furnace which show that with a cold furnace an average charge of 3,070 lbs. of steel for casting purposes were melted in 75 mins. with a consumption of 759 units per ton.

The furnace was operated continuously for ten hours, and after the first five heats had warmed up sufficiently to melt the same charge in 40 to 50 mins. with a current consumption of 450 to 550 units per ton.

In the above test the time and power consumption were both increased by reason of the refining period, during which alloys were added after the steel had been melted and brought to the required temperature.

The charge consisted of ½ borings and turnings, ½ miscellaneous scrap, and ½ foundry returns. The above test was not made under any special conditions, and is what should be easily obtainable in a well-designed furnace and under efficient operating conditions.

The writer can only suggest that the furnace used by Mr. Hyde is subject to high heat losses, or may have been operated under inefficient conditions. So far as the writer is aware there is no justification for his assumption that some latent heat is required in the melting of cast iron.

The tests mentioned were made with a Swindell Multiple Melting Furnace, made by William Swindell & Brothers, Pittsburgh, Pa. U.S.A.—Yours, etc.,

C. H. J. Trutch, B.Sc., A.M.I.E.E.

Newbold-on-Avon, Rugby.
July 29, 1926.

[We believe that if our correspondent would estimate in his own mind how many units it would take to melt cast iron in the furnace referred to, using his experience on steel as a basis, and then carry out the work in practice, he would probably confirm Mr. Hyde's impression that the melting of cast iron in the electric furnace does consume more current than one would anticipate and that the two processes are not strictly comparable.—Editor.]

Perlit Propellers.

To the Editor of The Foundry Trade Journal.

Sir,—In your Journal I have read some correspondence dealing, in part, with the making of large propellers by the Perlit method.

For years I have been concerned in propeller founding and have examined many which have failed in service, some through weakness, others through corrosion and erosion of those parts of the blades which originally consisted of chilled iron infested by dirt, oxides, slag, and gas cavities. It was one of those foundry problems which nobody seemed to attempt to solve, the good old way being as far as our ideas would take us.

The Perlit propellers now being evolved are the first definite improvement I have witnessed in propeller manufacture. I have seen large Perlit blades having practically the same grain throughout. A recent Perlit propeller gave a high test at the edges of the blades, a similar test further up towards the root, and an even higher figure at the boss itself. Moreover, those parts of the blades subject to the above-mentioned corrosion and erosion consist, in the Perlit casting, of machinable, pearlitic and clean metal. *The results are of the highest interest and importance.*

Ever since I can remember, ordinary cast-iron propellers have been prone to serious defects arising out of the metal and the methods of using it. To-day several of these troubles have been overcome, our knowledge of the subject has advanced, results of practical value have been obtained, *and* the work is progressing.—Yours, etc.,

Horace J. Young, F.I.C.

3, Central Buildings, Westminster.
July 30.

Pearlitic Cast Iron.

To the Editor of The Foundry Trade Journal.

Sir,—It is quite pleasing to read Mr. Raikes' letter in your issue of the 29th inst., as he entirely confirms the first two points raised in my letter in your issue of July 8, whilst not denying the other points raised:—

1. That equal and superior tests are obtained outside of the Perlit process, which admission surely includes impact tests.

2. That a propeller made by the Perlit process the casting is not close-grained and of pearlitic structure throughout.

(Incidentally, it is unfortunate that Mr. Raikes is not consistent, for whilst in paragraph 3 of his letter he admits my contention that the same grain size cannot be obtained in the boss and blades of a propeller cast by the Perlit process, yet in paragraph 2 he states "Perlit castings possess *uniform properties at all points.*")

3. Will Mr. Raikes allow me to refer him to his Oxford Dictionary as to the definition of the word "empirical," which was the one actually used in my letter. The following are two of several definitions of the word given in that work:—

(1) Of a physician, that bases his methods of practice on the results of observation and experiment, not of scientific theory.

(4) In mathematics, a formula arrived at inductively and not verified by productive proof.

In quoting from the definition of "empiricism" Mr. Raikes' quotation is comparable to No. 1 of the above, whilst the sense in which the word "empirical" was used in my letter was obviously the second of the above, namely, No. 4 of the dictionary. Further comment on the accuracy and mean of my use of the word "empirical" is therefore unnecessary.

So much for the three points.

Now, with regard to Mr. Raikes' claim in connection with growth, will be be good enough to publish strictly comparative data to substantiate his statement, the comparative material used, and the method of carrying out the tests to be accepted to the interested public. *Proof* is all the public require.

It is quite evident that Mr. Raikes is not aware of all the claims made on behalf of Perlit iron. Let me assure Mr. Raikes that I have no personal interest, direct or indirect, in any other patented process for making Pearlitic cast iron, and am not therefore writing on behalf of any such process, my criticism being purely technical in the interests of truth and based upon personal experience.

Academic discussions based upon experimental laboratory data are not always applicable to works practice. This fact is now generally admitted even by academics of great eminence.—Yours, etc.,

E. Adamson.

Sheffield.
July 30, 1926.

Mr. W. H. Poole, director of the Keighley Laboratories, who recently underwent a serious surgical operation, is now convalescent, and hopes to resume duties in the course of a few days.

Mr. Thornycroft Donaldson, a director of the company, who has been for a number of years in charge of the engineering side of Thornycroft's Southampton Works, has now been appointed general manager of John I. Thornycroft & Company, Limited.

The Birmingham Works of H. H. Vivian and Company, Limited.

The Icknield Port Road Works, Birmingham, of Messrs. H. H. Vivian & Company, Limited, are amongst the oldest works in the Birmingham district solely devoted to the non-ferrous metal industry. They were established on their present site by H. Hussey Vivian, who afterwards became

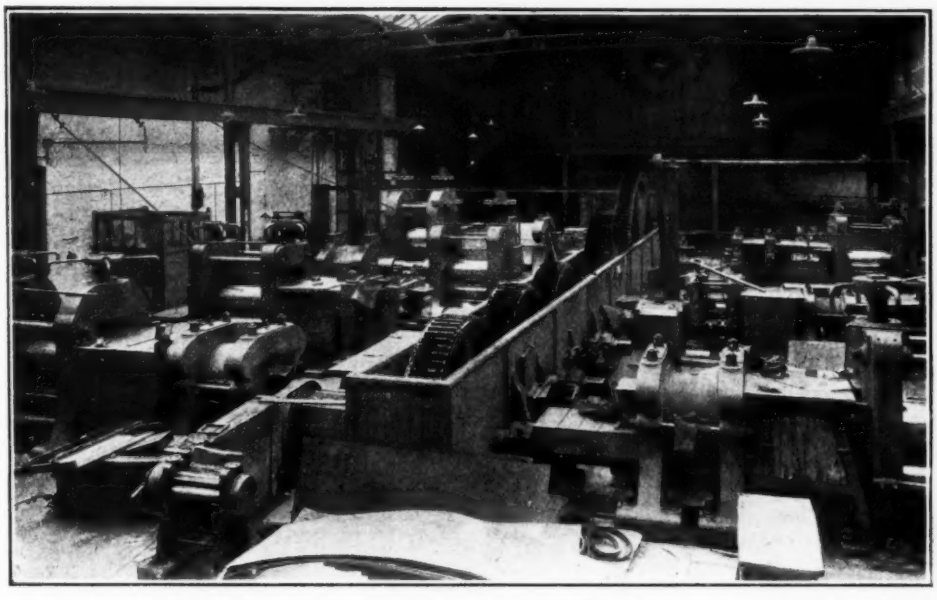


Fig. 1.—New Cold Rolling Mills.

the late Lord Swansea, in 1860 for the manufacture of German silver (now called nickel silver) in sheet, strip, wire, spoon and fork blanks, etc., as also for the manufacture of brass and copper tubes, rolled metals and wires. Additions were from time to time made to the works and plant, and ultimately the offices and warehouses were transferred to George Street, St. Paul's, Birmingham.

Fig. 2.—Part of the Heavy Tube Mill with Benches Driven Individually by Electric Motors.

and the business converted into a public liability company under its present style.

The Company were pioneers of cupro-nickel for making coinage, and this was also extensively used by the Government. At that time the Company were owners of nickel mines in Canada and Norway, and for the purpose of smelting the ores, the product of which was of a high commercial value, works were erected in Swansea. At a later period, however, it was considered desirable to dispose of this branch of the business in order to enable the management to concentrate the more efficiently upon its older and more important manufactures, brass and copper tubes, rolled metals, etc., amongst the best known of which is the "Durable" brass condenser tube, which is the outcome of a careful study over a number of years of the corrosion of condenser tubes. Purity of the metal used is of course the first consideration, but particular care is taken during the heat-treatment to ensure freedom from internal stresses and suitable temper for the exacting duty.

From the outset the Company have been amongst the pioneers to adopt modern methods of manufacture, but during the past few years the works have been almost entirely reorganised, particularly with a view to ensure perfect continuity of operations with a minimum of handling—a by no means simple proposition in a works which has entirely outgrown the original ideas of output. It was further decided to adopt electrical driving throughout, and this meant the scrapping of several steam engines, amongst them a beam engine which drove the whole of the hot mills.

The electrification of a works presents no material difficulty when the capital cost is not a

paramount consideration, but when such work has to be carried out during a lean period of trading, economic considerations demand that costs must be kept down to the very minimum. Under such conditions it is by no means easy to devise a conversion which does not embody, more or less, a sacrifice of efficiency. The Icknield Port Road Works are an exception to that rule, inasmuch that whilst so far as possible component parts of the old drive have been retained in service, the scheme in its entirety has been so carefully thought out that such retentions have in no wise impaired the overall efficiency.

The present activities of the Company embrace solid-drawn brass tubes for locomotive boilers, condensers, etc.; solid-drawn copper tubes for all purposes; rolled metal in copper and brass for motor engineering, stamping, spinning and the like; wires in brass and copper; drawn brass; lock plates and sections; high-conductivity copper strip, segments, wire and bars and nickel silver in sheets, wires, etc., for all commercial purposes.

The metal stores are centrally placed. It may be noted in passing that no foreign scrap is purchased, only best copper and spelter being used together with customers' scrap, the alloy of which last is, of course, a known factor. The heats are weighed into special boxes which are delivered by a Morris 1-ton overhead runway to the various foundries.

There are five foundries, ranged in a line of buildings, but otherwise self-contained shops each devoted to a particular manufacture. Experience has shown that such an arrangement is more advantageous than assembling the whole of the processes of casting in one large foundry. Not the least of such advantages is that the separate location enables better working conditions to be

Fig. 3.—Brass Condenser Tube Mills.

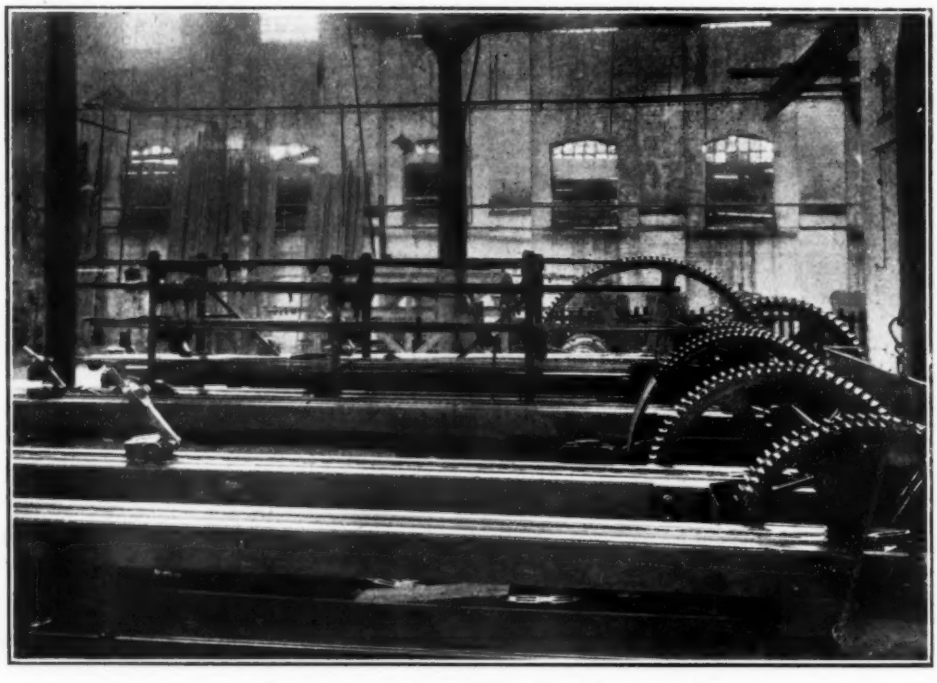


Fig. 4.—Part of Light Tube Mill.

provided for the men, thus making for higher efficiency.

In each of the casting shops a fan is installed in the roof, giving very effective service; indeed, there is nothing in the atmosphere of the shops to indicate the nature of the work carried out.

All the cores are hand-made, the loam being ground in a pan mill. The dirt is crushed in a

FIG. 5.—OLD BEAM-ENGINE HOUSE, SHOWING ROPE DRIVE CONVERSION.

second pan mill and then passed through the usual washing process for the recovery of the metal. There are four drying stoves, which are coal-fired from a common furnace operating on natural-draft. The mills and the cutting-off saw in the core shop were formerly driven by a steam engine. The electrical conversion is of the simplest form, consisting of nothing more than coupling the motor to the driving shaft and disconnecting the piston rod of the engine, so that the flywheel effect is retained.

The most recent addition to the works plant is the cold-rolling mill for the manufacture of copper, brass and nickel sheets, strip, etc. The mill consists of a stand of 24-in. breaking-down rolls, three stands of "getting-down" rolls, four stands of sheet-finishing rolls, and five stands of strip rolls. As will be seen from our illustration (Fig. 1), the rolls are ranged on either side of the train of driving gear. The latter was built by the Harland Engineering Company, and is a very nice job, running smoothly and silently. The gear is driven by a 400-h.p. G.E.C. motor through a Power Plant Company totally-enclosed reduction gear. The rotary shears and the 5-ft. guillotine are driven from a countershaft by a 10-h.p. motor.

The mill is served by furnaces built by the Company, each 14 ft. × 5 ft. 6 in. The furnaces are gas-fired with a central producer, and in common with all the annealing furnaces, are provided with pyrometers. The mill floor in front of the furnaces is laid with steel plates, and the rest is covered with "Ironite."

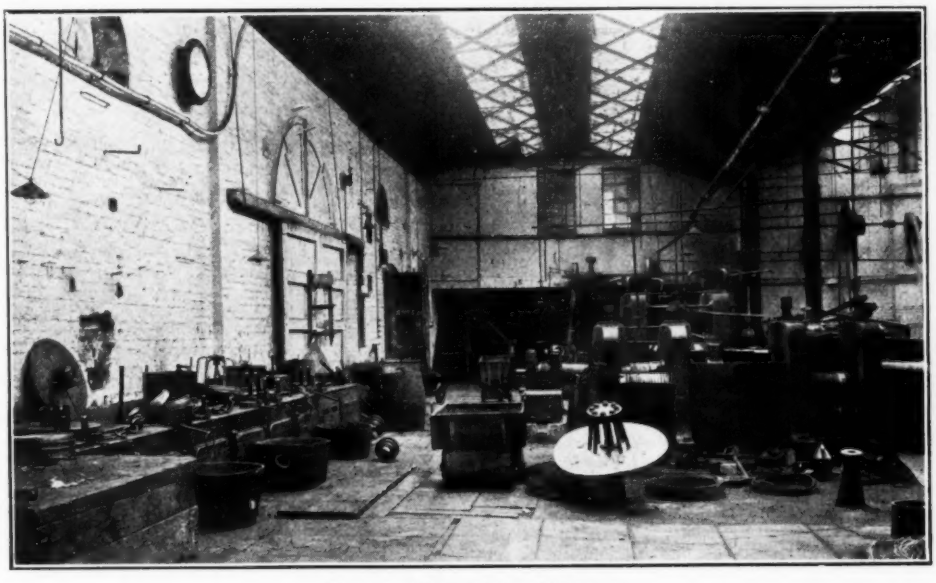


FIG. 6.—COPPER TAPE MILLS.

It will be understood that this mill had to be

fitted into the existing works, one of the inconveniences of the arrangement being that all the metal had to be conveyed right across the works for cleaning. This difficulty, however, has now been overcome by driving a short incline from the mill floor into the basement below the offices; immediately above this basement the despatch warehouse is situated. The pickling vats, washing vat, cleaning machine and stove are installed in the basement, whilst a well in the floor of the warehouse enables the finished product to be handled by a G.E.C. 1-ton hoist; pilot lights indicate to those in the shop when the hoist is in service. In addition to the usual platform machine, the warehouse is equipped with an Avery 7½-cwt. automatic weigher—obviously a great time-saver when dealing with parcels of mixed weights. From the weigher the parcels are delivered by overhead runway to the loading bay, which is equipped also with an electric runway.

The tube mills are divided into three sections, namely, the heavy tube mill for large brass and copper tubes, the light tube mill for smaller brass and copper tubes, and the condenser tube mill. All these mills are electrically driven, and in the heavy tube mill there is a separate motor for each bench. In the light mill a 100-h.p. motor drives a group of benches, and in the condenser tube mill the benches are grouped in units, each driven by 40-h.p. motors.

The hot mill is equipped for rolling brass and copper sheets, sections and wire. The whole of the hot mills were formerly driven by a beam engine installed in a house between the copper and brass mills. The beam engine drove the mill shaft through a chain of gear. The mill shaft also carried a rope wheel, the original duty of which was to drive through ropes a cogging mill installed on the first floor, but which has been out of commission for some years. When it was determined to displace the beam engine with an electric motor it was decided to retain the actual mill drive and to bring into service the rope wheel on the driving shaft. The conversion, therefore, was made by dismantling the beam engine and placing a motor on the first floor and utilising the old pedestals for carrying the motor rope wheel. The motor is of the Westinghouse Company's manufacture, 200-h.p., 3-phase, the drive to the mill shaft being through three ropes—Dawson's Lincona "V" Balata belts. This proves an efficient drive; in point of fact, the three ropes are simply employed to make assurance doubly sure, as it was found in practice that the motor could be stalled when driving through only two of the ropes. The hot copper and tube mills are driven through a solid coupling, whilst the hot copper and brass sheet mills are driven through a claw clutch operated by hand-wheel. Three variations of the mill speed are obtained through resistances. The space occupied by the beam engine has been turned to useful account as a central oil stores, etc.

The wire mill is equipped for making copper and brass wire and also high-conductivity copper bars, tape and sections. It is electrically driven on the group system by a 200-h.p. motor and a 40- and 25-h.p. Most of the annealing furnaces are served by central Dowson-Mason producers, but there are several coal-fired furnaces in positions where gas could not be conveniently supplied. The steam for supplying the producers and for heating the pickle baths is raised in two Lancashire boilers. Water for the whole of the works supply is obtained from a deep well. The pumps are now being driven by a 25-h.p. motor of B.T.-H. manufacture. The original engine drive, however, has been retained, the motor driving the countershaft with a short belt. The water is pumped to an elevated tank which gives the necessary head for circulation throughout the works.

There is a well-equipped laboratory, all raw materials being subject to analysis here; Fletcher furnaces are also installed for the treating of test-pieces, as also for research work in heat-treatment, whilst physical tests are made upon a Buckton 15-ton machine which is direct motor-driven.

A Coating for Chills.—A safe coating for chills (inner surface) is French chalk, finely powdered and mixed with good-quality paraffin. Only a very little of this wash is necessary for the average chill.

Iron and Steel Institute.

Stockholm Meeting.

In accordance with previous announcements, the Autumn Meeting of the Iron and Steel Institute will be held, by kind invitation of the Board of Directors of Jernkontoret, at Stockholm. The sessions will take place at the Palace of the Nobility (Riddarhuset), Stockholm, on Friday and Saturday, August 27 and 28, commencing at 10.30 a.m. each day.

The Hon. Secretaries' office will be open at the House of Jernkontoret on Thursday, August 26, at 10 a.m., for the distribution of programmes and badges.

At the conclusion of the meeting, alternative visits have been arranged to works and mines in Central Sweden.

The following is the list of Papers which it is expected will be submitted to the meeting:—

(1) "The Effect of Nitrogen on Chromium and some Iron-Chromium Alloys" (Alloys of Iron Research, Part IV), by F. Adcock.

(2) "A Physical Investigation into the cause of Temper Brittleness," by J. H. Andrew and H. A. Dickie.

(3) "Anomalies in Heat Conduction, with some Determination of Thermal Conductivity in Iron and Carbon Steels," by C. Benedicks, H. Bäckström and P. Sederholm.

(4) "Electro-chemical Potentials of Carbon and Chromium Steels," by C. Benedicks and R. Sundberg.

(5) "The Treatment of Steel with Ferro-Carbon-Titanium," by G. F. Comstock.

(6) "The Mechanical Properties of Four Heat-Treated Spring Steels," by G. A. Hankins, D. Hanson and Miss G. W. Ford.

(7) "Is the Direct Change from Austenite to Troostite Possible?" by K. Honda.

(8) "The Carburisation and Decarburisation of Iron and Some Investigations on the Surface Decarburisation of Steel," by A. Johansson and R. von Seth.

(9) "The Development of the Swedish Iron and Steel Industry during the last 30 years," by A. Johansson and A. Wahlberg.

(10) "Notes on Jernkontoret," by E. Kinander.

(11) "The Testing of Hardened Steel," by A. Lundgren.

(12) "Notes on the Development of the Swedish Mining Industry during the last 25 years," by W. Peterson.

(13) "The Constitution of the Iron-Silicon Alloys," by G. Phragmen.

Head, Wrightson & Company, Limited.—Sir Guy Wrightson, Bt., presiding at the 36th annual meeting, said that each year since the war they had been struggling against upheavals which had always occurred just when there were some small indications of increased volume of trade. In 1919 and 1920 they had a serious moulders' strike; in 1921, stoppage in the mining industry; in 1922, the engineers' dispute; in 1923, upset in trade due to the occupation of the Ruhr; and in 1924-25, the shadow of another mining dispute and further depreciation of Continental currencies. This year culminated in a general stoppage. No industry dependent upon an export market for the sale of its productions could stand those repeated setbacks without jeopardising its future. In addition to those blows they had a large portion of the globe which in the ordinary course of development would have been calling for railway material, mining material, and other products entirely closed to them and the rest of the manufacturing world. He referred to the undeveloped portions of China and also Russia. That contracted the area of the consuming markets, and consequently the scramble for orders continued, showing itself in prices cut beyond all reason in the desire to get a turnover to cover the standing charges of such manufacturing works as their own, the first and most obvious way being to spread those charges over a larger output; but a point had been reached where those charges, which were in many cases represented by the services of sheltered trades, could not be covered by extra output at the low prices current. Therefore they must get some relief from those sheltered trades.

The Detroit International Convention.

The Programme Committee of the American Foundrymen's Association announces its tentative schedule for the thirtieth annual convention and second international foundrymen's congress to be held in Detroit the week of September 27. The programme includes papers by American and European writers dealing with the latest researches and developments in cast iron, steel, malleable, and non-ferrous fields. The feature of the Convention will be a symposium on permanent and long-life moulds. The programme as tentatively arranged is as follows:—

Monday, September 27.

1.30 p.m.—Opening Meeting. Addresses of Welcome and Responses.

3 p.m.—Non-Ferrous Metals.—Joint Meeting of A.F.A. and Institute of Metals Division.

"Constitution of Aluminum-Zinc-Tin Alloys and Aluminum-Zinc-Cadmium Alloys," by Dr. V. Jares, Technical School, Prague.—Exchange Paper of Czecho-Slovak Foundry Association.

"Aluminum-Alloy Permanent Mould Castings," by Dr. R. J. Anderson, Cleveland.

3 p.m.—Materials Handling:—

"Materials Handling in a Foundry," by E. T. Bennington, Cleveland Crane & Engineering Company, Cleveland.

"Saving Foundry Materials Handling," by H. J. Payne, Society for Electrical Development, New York.

3 p.m.—Core Binders and Cores:—

"Core Oil Specifications," by V. A. Crosby, Studebaker Corporation, South Bend, Ind.

"Core Binders Investigation," by H. L. Campbell, University of Michigan, Ann Arbor, Mich.

"Core Sand Mixture Tests," by C. A. Hansen, General Electric Company, Schenectady, N.Y.

Tuesday, September 28.

10 a.m.—Steel Founding:—

"Defects in Steel Castings," by J. M. Sampson, General Electric Company, Schenectady, N.Y.

Contribution by R. A. Bull, Electric Steel Founders' Research Group, Chicago.

10 a.m.—Temperature Determination in the Non-Ferrous Foundry—A Symposium. Joint Meeting of A.F.A. and Institute of Metals Division.

A. A. Grubb, Ohio Brass Company, Mansfield, Ohio.

H. M. St. John, Detroit Lubricator Company, Detroit.

Kirtland Marsh, Aluminum Company of America, New Kensington, Pa.

R. R. Clarke, General Electric Company, Erie, Pa.

Representative, United States Bureau of Standards, Washington.

A. S. Hall, Thwing Instrument Company, Philadelphia.

R. D. Bean, Brown Instrument Company, Philadelphia.

10 a.m.—Apprentice Training:—

Discussion of Apprentice Training.

12.15 p.m.—Round Table on Brass Foundry Topics:—

Luncheon meeting and informal discussion. Joint Meeting of A.F.A. and Institute of Metals Division.

2 p.m.—Permanent and Long Life Moulds—A Symposium:—

J. E. Hurst, Newton, Chambers & Company, Limited, Sheffield, England.

H. A. Schwartz, Cleveland.

Leon Cammen, American Society of Mechanical Engineers, New York.

S. M. Udale and H. P. Kimber, Holley Carbureter Company, Detroit, Mich.

James A. Murphy, Hamilton, Ohio.

Dr. Richard Moldenke, Watchung, N.J.

2 p.m.—Cupola Practice:—

"Melting All Steel Heats in the Cupola," by T. F. Jennings, Garfield Copper Company, Garfield, Utah.

"A Study of Iron Melted in the Cupola," by R. E. Wendt and J. P. Walsted, Purdue University, Lafayette, Ind.

"Use of Continuous Iron Temperature Charts in Improving Cupola Practice," by H. W. Dietert, United States Radiator Corporation, Detroit.

"Cupola Practice in a Continuous Foundry," by H. Rayner, Dodge Brothers, Detroit.

Wednesday, September 29.

10 a.m.—Steel Foundry Metallurgy:—

"Open-Hearth Slags," by W. C. Hamilton, American Steel Foundries, Granite City, Ill.

"Manufacture of Manganese Steel for Castings," by John Howe Hall, Taylor-Wharton Iron & Steel Company, High Bridge, N.J.

10 a.m.—Testing Cast Iron:—

"A Shearing Test for Cast Iron," by G. K. Elliott, Lunkenheimer Company, Cincinnati.

"Test of Cast Iron," by W. Rother, Buffalo Foundry & Machine Company, Buffalo.

"Some Further Grey Iron Problems," by John Shaw, Brightside Foundry & Engineering Company, Sheffield, England. Exchange Paper of the Institute of British Foundrymen.

"Testing Cast Iron," by M. le Thomas, Paris, France. Exchange Paper of the French Foundry Technical Association.

10 a.m.—Malleable Cast Iron:—

"Some Controversial Matters Pertaining to Malleable Iron Castings," by Enrique Touceda, Albany, N.Y.

"What May Be Required of Malleable Cast Iron," by H. A. Schwartz, National Malleable & Steel Casting Company, Cleveland.

10 a.m.—Casting Nickel Alloys:—

Meeting of Institute of Metals Division, A.I.M. and M.E.

2 p.m.—Foundry Costs:—

Discussion of general needs for foundry cost methods and exposition of a specific foundry cost system for practical use.

2 p.m.—Foundry Refractories:—

Report of the Chairman of the Joint Committee on Foundry Refractories.

Report of Sub-Committees on Survey of Service Conditions.

(*a*) Steel foundries.

(*b*) Malleable foundries.

(*c*) Cast-iron foundries.

Report of Sub-Committee on Testing and Specifications.

Report of Sub-Committee on Standardisation and Simplification.

Discussion of foundry refractories.

Thursday, September 30.

10 a.m.—Foundry Sand Control:—

Reports of Sub-Committee of Joint Committee on Moulding Sand Research.

Discussion of methods for practical shop control of foundry sand conditions.

12.15 p.m.—Round Table Malleable Foundry Problems:—

Luncheon meeting and informal discussion of malleable foundry topics.

1.30 p.m.—Business Meeting.

2.30 p.m.—Cast Iron:—

"The Dilatometric Analysis of Iron," by A. Portevin and P. Chevenard, Exchange Paper of the French Foundry Association.

"Heat Resistant Cast Irons," by Oliver Smalley, New York.

"The Perfecting of Pig Iron," by Dr. Piwowarsky, Technical High School, Aix-la-Chapelle, Germany, contributed on behalf of the German Foundrymen's Association.

"Phosphorus in Cast Iron," by J. T. MacKenzie, American Cast Iron Pipe Company, Birmingham.

"Chaplets in Heavy Iron Castings," by Ivan Lamoureux, Exchange Paper of the Belgium Technical Foundry Association.

2.30 p.m.—Elimination of Waste in the Foundry Industry:—

Discussion of possibilities of elimination of waste.

Report of Committee on Pattern Equipment Standardisation.

Report of Committee on Corrosion of Metals.

Friday, October 1.

10 a.m.—Foundry Sand Control:—

"Metallurgical Control of Foundry Sands," by L. B. Thomas, Fairbanks Morse Company, Beloit, Wis.

"Grading Foundry Sands," by C. A. Hansen, General Electric Company, Schenectady, N.Y.

"Foundry Sand Control," by O. E. J. Abrahamson, American Radiator Company, Buffalo.

The Selling of Castings.—XXX.

By Voyageur.

Co-operative Selling.

This series of articles would be seriously wanting if it failed to give any reference to the subject of selling co-operatively in overseas countries. Varieties of co-operative selling are numerous, but in essence they all consist of the establishment, by a certain number of firms in association, of a representative or representatives in certain countries, or in a certain country, for the purpose of selling the castings they make. This representative is allowed to handle no castings but those of the firms who collectively employ him, and they alone provide him with his payment. Management is in the hands of a central body made up of one representative from each of the associated companies, and this body holds its meeting at regular intervals in the home country, usually at some convenient centre. Each firm sends its invoices direct to the consuming house, but includes in its charges a small commission for the representative, enough, as a rule, to meet his salary, that of his staff, and any additional approved expenses that he may incur, and that he has indicated to his employers. Occasionally, these salaries and costs are considered a separate item, and the various associated firms contribute annually as much each as will suffice to cover them, commission being left for individual negotiation. This is, perhaps, the more convenient plan, since it gives the representative greater margins in dealing with acute competition.

In support of co-operative selling, it is argued that manufacturers have more adequate and immediate control of the selling in overseas countries where it is in force than they have over an ordinary agent. The relation between manufacturer and buyer is not interrupted by the existence of an external and profit-diverting intermediary. Furthermore, the scheme has greater stability than the ordinary agency method, since the agent can at will throw over the founder if he thinks he will get better terms from another, whereas the co-operative selling office is unable to do so. The expense is smaller than that of keeping up separate branch offices for each firm. And in conclusion, it is claimed that selling is more economical, since a man selling one type of casting might just as well sell another, so long as the two have a related purpose and do not compete. As an example, one might mention steam dryers, wherein both brass and steel castings are needed. Alternatively, of course, the founder might join a scheme in which no other founder co-operated, but in which makers of other engineering products shared. The salesman employed by one firm alone can only spend his time in selling the products of that firm, which means, ultimately, that the buyer has to be interviewed by far more salesmen than is really necessary. This naturally limits the amount of time he can afford to each.

Disadvantages.

While much can be said for this method of selling, its disadvantages have to be carefully weighed. First of all, co-operative selling has not the same appeal to the large, well-capitalised founder as to the smaller manufacturer, whose financial position is not such as will allow him to organise a series of separate branch offices in all quarters of the globe. Naturally, a salesman who has to concentrate all his efforts on selling one type of casting or product alone, is likely to sell that type or product more efficiently than he could if he had to sell half a dozen, with the additional necessity of having to give equal time to all six. For this reason, it is more profitable for the firm that can afford it to establish its own branch offices, with, for preference, its own foundry-trained staffs, whose business is solely that of selling its own castings.

Again, though the salesman for the co-operative selling office may be a highly intelligent and efficient salesman, it is hardly likely that he will be able to sell things as widely different as leather belting and iron castings, or steel castings and gunmetal castings, with equal ease and proficiency. This argument applies, also, to the ordinary agent; but it must be remembered that the argument for co-operative selling is that it is a superior form of selling, not merely one equal, to that of the separate agency. These and other conclusions have made it fairly clear that the only forms of co-operative selling likely to prove successful in practice are those whose basis is something wider than that of mere absence of competition among the associated firms. So far as castings are concerned, the sole trustworthy scheme is that which consists of a group of firms all manufacturing goods needed by a specific portion of the consumer's works. For example, a dozen firms making articles needed in a machine-shop might join for the purpose of selling co-operatively in, say, Russia or Japan. These articles might include specialties as widely different as lubricating oil, steel castings, machine tools, cotton waste, and so forth, but all would be related to this extent, that they were all used under the same roof, and probably all purchased by the same official.

The principal objection to the co-operative scheme is, however, that something more than mere glib salesmanship is necessary for the efficient selling of castings. A thorough understanding of engineering practice in general and of the casting's own particular technicalities are essential. It is obvious that one man cannot know all there is to know about steel castings AND lubricating oil AND cotton waste AND machine tools, and so forth. He may have a broad general notion of each, and a detailed and intimate knowledge of two or three, but this is insufficient. An overseas salesman has more often than not to overcome practical difficulties, and to give expert advice, both of which functions necessitate intimate knowledge. The representative of the co-operators might at any moment be found lacking in particularised knowledge of one or other of the types of goods he had to sell.

Superiority Over Individual Agent.

Again, the central body of control does not work so well in fact as it does in principle. Committees soon grow unwieldy, the assembly of all the representatives is not easy to arrange, too much talk often hinders progress, and occasionally clashes of opinion create strife, which may at any moment cause a defection and throw the entire scheme out of joint. These possibilities of failure must be taken into account. But at the same time, co-operative selling is a very valuable substitute for the independent agent, to whom is frequently paid commission on orders that have in no way been secured as a result of his efforts. It cannot give to the founder the same advantages as would his own branch office, but it should be carefully examined by smaller founders who find their selling arrangements in overseas lands far from satisfactory.

(To be Continued.)

Softening Chilled Castings.—Heat the castings until they assume practically a white heat. Cover immediately with a good, even depth of sand. Leave the castings in the sand bed until they are perfectly cold.

Grey Iron Castings for Special Needs.*

By Horace J. Young, F.I.C.

The commercial melting of cast iron for high-class work is carried out, in this country, either by means of—(a) a modern cupola furnace, or (b) an air furnace; the former being a cupola fitted with attachments to enable both the volume and pressure of the blast to be regulated at will throughout the "blow"; the latter a reverberatory-type open-hearth furnace.

By either method may be produced cast iron of the composition recommended by modern knowledge. For example, each of them can give metal of total carbon content as low as 2.6 per cent.

In the case of the cupola, this is done by using charges high in steel, controlling the blast-pressure and volume and limiting the coke to the lowest amount necessary to consume the oxygen of the blast-air, and, at the same time, give metal at the required temperature. There is nothing abnormal about this procedure in a modern cupola, and, for a long period, the author has produced, in this manner, cupola pig-iron similar to the low-carbon open-hearth irons made in Sheffield and elsewhere.

Therefore, both the cupola and the open-hearth furnace are capable of giving these low-carbon irons, but, unfortunately, the production, by either method, of sound castings entails some difficult foundry problems.

When, for instance, the metal is tapped from an open-hearth furnace, it has properties and temperate approaching those of the steel foundry, resulting in a large number of waster castings and in the necessity for using materials and methods more common to a steel than an iron foundry. Steel foundry procedure in an iron foundry is undesirable, and involves both expense and loss; moreover, the composition of the iron produced from an open-hearth furnace does not appear to be controlled as easily as that from a cupola. For many years the author has been unable to obtain air-furnace pig-iron, either to his own specified composition or to any constant composition suggested by the makers. He possesses a mass of evidence to the effect that the composition is never under such control as is essential to the purpose for which the iron is required.

In the case of metal of this low-carbon content produced from a cupola, there arises another set of difficulties. The super-heat of the metal is insufficient for pouring castings in iron of this class; in other words, it is that attained in good cupola practice, namely, about 1,475 deg. C., at the tapping spout.

Consequently, in order to make good castings of this iron obtained from the cupola, it is necessary to "dilute" it and thus transform it into such a metal as can be used satisfactorily at the superheat available. This may be done by adding carbon or silicon, or, possibly, phosphorus, but, obviously, when any one of these three is added, the original intention of producing a high-class iron has been defeated. Therefore, so far as cupola practice is concerned, it appears advisable to produce iron of such carbon content as can be dealt with under the range of methods and temperatures common to the iron foundry.

Such a metal is one containing a total carbon in the neighbourhood of 3 per cent.—say, 2.8 to 3.2 per cent.—with the silicon as low as possible—say, below 1.0 per cent., in the case of heavy Diesel castings—phosphorus below, say, 0.4 per cent., sulphur about 0.1 per cent., and manganese, 1 per cent. or more. Compositions of this class can be produced accurately from a cupola and may be poured directly into moulds of ordinary iron foundry sands.

Claims have been made regarding the necessity for a lower total carbon, but evidence proves that low silicon is of premier importance. Moreover, because iron of lower carbon content is so difficult to make consistently, and, when made, to use, it may be looked upon as an undesirable material for commercial purposes, at any rate, until all other irons have failed.

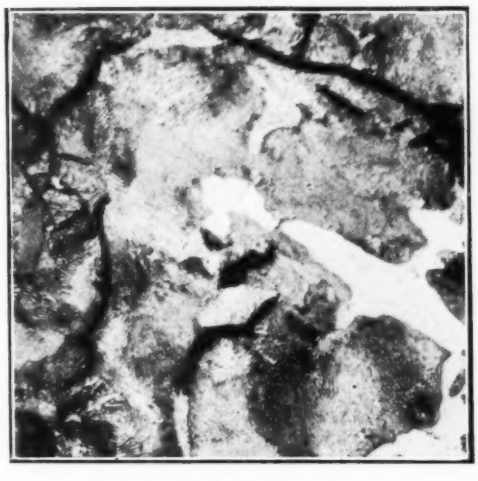


FIG. 1.

(FN 836) Graphite (black), Pearlite (lamellæ), and Cementite (white) in low-silicon medium-carbon iron. × 400 diameters.

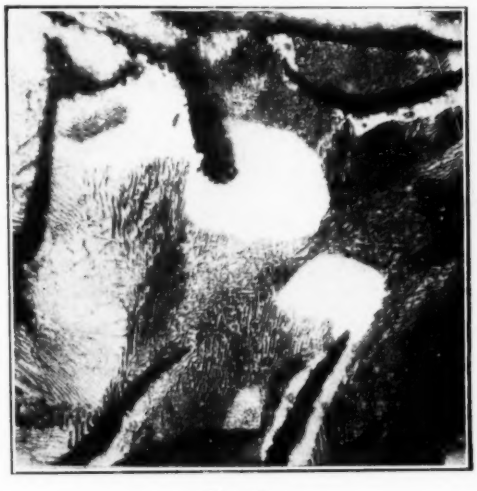


FIG. 2.

(FN 946) Graphite (black), Pearlite (lamellæ), and Ferrite (white) in high-silicon low-carbon iron. × 400 diameters.

The use of low-silicon metal gives rise to the chance of producing slightly cementitic iron; equally does the reverse apply that the use of high-silicon irons may result in a ferritic structure. A large high-silicon low-carbon casting, which the author has had the opportunity of examining, contained not only about 0.3 per cent. combined carbon and had large ferrite areas, together with thick and long graphite-voids. Fig. 1 shows a Perlit casting which, through incorrect procedure, contained some cementite, whilst Fig. 2 shows the high-silicon low-carbon iron of highly ferritic quality, as mentioned.

Results made on test-bars (cast as such) apply to nothing beyond the test-bars themselves. A very slow-silicon iron might give a partly-white or cementitic test-bar, whereas a higher-silicon iron would give a grey or ferritic test-bar, but the same two irons used on castings of larger or smaller section or mass (than the test-bar) would give entirely different results, both as regards matrix, graphite, and grain-size.

To sum up the case in practice, the point has been reached of being able to make iron contain-

* Extracted from the Journal of the West of Scotland Iron and Steel Institute.

ing 3 per cent. carbon or even 2.8 per cent., and of successfully pouring castings of it in the ordinary iron foundry, and of making it so that it contains predetermined amounts of the other elements, namely, silicon, phosphorus, sulphur, and manganese. Also, it is common knowledge that the iron in the test-bar (cast as such) is different from that in the casting it is supposed to represent; further, that the iron in the outside portions of any one section is different from that in the middle of the same section, and, finally, that the iron in a thin wall is different from that in a thicker wall of one and the same casting. Hence, no matter what the iron may be in the ladle or the test-bar, it is controlled ultimately by the conditions of cooling in the main casting, which conditions are peculiar to each design and weight of casting.

The above summary of the position as it stands in British foundries to-day is, in fact, altered little from what it was, say, five years ago. Not a few papers have been read consisting largely of reiterations of the desired compositions of the iron and the desired tests to be obtained from test-bars, and often ignoring almost entirely the influence of the cooling conditions upon which depend, finally and decisively, the properties of the casting delivered to the engineer.

It has been the habit of metallurgists and others dealing with cast iron to present photographs representing merely a pin-point of the metal, and showing, say, a pearlitic structure or a "star" graphite, without drawing attention to the fact that a movement of the microscope, to an area a fraction of an inch away, would show something different.

The subject of these pin-point photographs of cast iron is one which has become vital. In the hands of unscrupulous people, they are misused for no other purpose, apparently, than to mislead engineers. Recently a case occurred where two photographs were published side by side with a view to demonstrating the superiority of one iron over another. In the one photograph (of the iron to be lauded) was shown a perfect all-pearlitic circle, whereas the other one depicted a large phosphide "lake" and a sulphide globule, together with a small amount of pearlite. In spite of the fact that the two irons contained similar amounts of phosphorus and of sulphur, the operator forgot his profession so far as to present for comparison photographs of the above misleading type.

Pin-point photographs of cast iron are as useless for the purpose of ascertaining the homogeneity of the metal in the casting as would be, to take a parallel example, the photograph of the tip of a man's nose for the purpose of judging his physique.

In order to demonstrate the foregoing remarks, the author presents Figs. 3 to 7, which prove clearly how pin-point photographs could be misused by anybody either ignorant or unscrupulous.

The method which the author puts forward, for proving the homogeneity and uniformity of a section of grey cast iron, is that of a serial photograph, at a magnification of 25 diameters, taken continuously across the section. A larger magnification is undesirable because it embraces a smaller area of the specimen and gives no better conception of the graphite-voids.

A photograph of this type was shown, and, by bending it so that a field near to the centre of the casting comes alongside one near the outside, it will be seen that the metal is almost, but not quite, homogeneous. It is an example of a Perlit iron as made from superheated metal.

In comparison is Fig. 9, which represents part of a gas engine, of high-class manufacture, which part failed in service, as have others of similar make. Pin-point photography proved valueless in determining the cause of failure, but the serial photograph demonstrated the lack of ability of the metal, under the conditions of cooling, to produce a homogeneous article, no matter what its composition may have been when tapped from the cupola or what result it gave in the testbar (cast as such).

The solution of the main problem, namely, lack of homogeneity and uniformity in a grey-iron casting—is to control the cooling conditions, so that the iron used may occur in the state desired throughout each section and all sections of every casting.

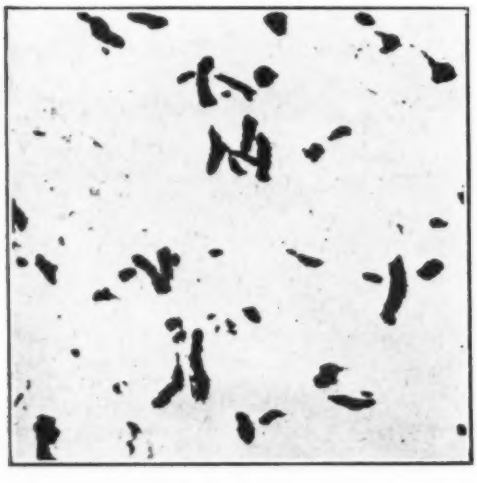


FIG. 3.

(FN 1048) Photograph of Graphite in an area immediately adjacent to that shown in Fig. 4. × 75 diameters.

FIG. 4.

(FN 1049) Photograph of Graphite in an area immediately adjacent to that shown in Fig. 3 × 75 diameters.

Referring to the second photograph of the gas engine casting, it becomes obvious that at one point, and one only, the metal is at its best, for the reason that, at that point, the cooling conditions chanced to be ideal. Equally is it obvious that at all other points the metal is, to a greater or lesser degree, worse because, to a greater or lesser extent, the cooling conditions have been unsuitable.

To control the cooling on the principle and in the manner originated by Diefenthaler, sums up, fundamentally, into getting into the mould the number of heat units necessary to produce the required cooling-rate for the particular iron used at the particular average thickness and mass concerned. These heat units may be introduced in several different ways. In one particular series of irons, or of castings, it is more convenient to pre-heat the moulds by external than internal means. The cooler ends of any Diefenthaler curve may be applied, to suitable cases, with every success.

Diefenthaler's constructive faculty, as embodied in his invention, namely, that grey cast iron, of all compositions, should have a certain definite structure, which structure should be aimed at, no matter what the size or shape of the casting—including, as it does, not only a substantially pearlitic matrix, but a uniform distribution and

size of graphite and of grain size—is of great value to those concerned in the commercial production of grey-iron castings for special needs. Diefenthaler indicated the desired result, and also demonstrated several means whereby it could be obtained. By working on these lines the power to make good castings of good material is enhanced to a remarkable extent.

In Perlit procedure the operator makes the outside parts of a silicon similar to the centre, whereas, previously, in ordinary work, one aimed at making the centre like the outside, and seldom succeeded. The use of hot moulds is not so difficult as has been suggested and any modern core stove, with a fan attached to the furnace, will give the required temperatures.

Core oils can be used with impunity, and after trying several of those on the market, the author has yet to find the one which will not stand up to the job.

In ordinary work the iron-founder has restricted himself to the use of irons which give a good-looking casting, to the exclusion of those which give a high-class metal. Irons lower in phosphorus, sulphur, and carbon, than ordinary cast iron are not so easy to manipulate, and the foundrymen have fought shy of them.

In all good work the highest skill of the moulder is required, and until he is accustomed to making the particular design concerned, there is the possibility of failure.

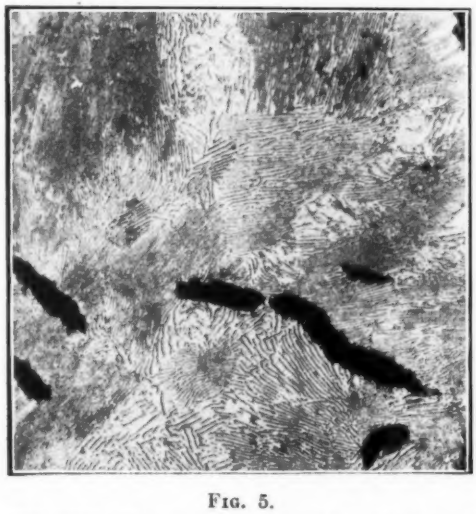


FIG. 5.

(FN 1050) Photograph of Graphite (black) and Pearlite (lamellæ) in a sample from which Figs. 6 and 7 were taken. × 400 diameters.

FIG. 6.

(FN 1051) Photograph of Graphite (black), Phosphide (mottled), Sulphide (half-tone), Pearlite (lamellæ) and Cementite (white) in a sample from which Figs. 5 and 7 were taken. × 400 diameters.

It seems to be true, unfortunately, that every superior metal or alloy presents its own foundry problems. For instance, a brass foundry accustomed to dealing with castings in common gunmetal, finds difficulty when using Admiralty gunmetal or phosphor bronze. The better the alloy and the more rigid the requirements, so must be the foundry procedure and the metallurgical knowledge and control. In the manufacture of steel castings we have, as a nation, found this to be true, and our Continental competitors are reaping yet the advantage of their greater respect for applied science.

Cast iron of the future will be considered as steel now is, namely, a metal homogeneous throughout—in composition, structure, and grain size—having to pass searching tests, representative of the casting itself, and containing specified amounts of each element entering into its composition.

There are numberless constructions to-day where the engineer would decrease his sections and lighten his machines if he could obtain a reliable cast iron; many others where steel castings, malleable castings, and even forgings are used, for no other reason than that of the unreliability of cast iron. To these points are to be added the not unimportant fact that steel or malleable castings, although expensive as compared with cast iron, are not always satisfactory. The author knows of many cases where the engineer would go back gladly to cast iron could he rely upon obtaining castings of equal strength and grain in every section.

If a grey-iron casting can be made so that it gives, say, 13 tons throughout, and is close and tough in every part, thick or thin, then a definite advance has been procured, resulting in the re-establishment of the engineer's confidence in cast iron.

The deplorable and long-established custom of referring to cast iron in terms of the tensile strength of testbars (cast as such) is one which is bound to give place to definite specifications of the composition and properties of the material in the actual casting which the engineer is going to use.

Too much stress has been placed upon pearlitic structure and too little upon homogeneity. If a casting is homogeneous the actual amount of combined carbon may be 0.7 or 0.9 per cent., according to what is required, and there is small need in commerce to worry whether the structure is perfectly pearlitic in the academic sense. Further, in some castings for some purposes it may be advisable to have present a little free ferrite or free cementite, and, again, so long as homogeneity is obtained, the result is satisfactory.

In the general run of things a substantially all-pearlitic structure is the main aim of the principle and process, demonstrated by Diefenthaler, for all types and compositions of cast iron, and the author has found it possible, working on these lines, to produce anything from very hard iron to very soft iron and to obtain homogeneity. Although the former may be slightly cementitic and the latter slightly ferritic, the invention of Diefenthaler is applicable commercially to extreme cases as to the more normal ones.

In order to prove whether homogeneity was a fact in Perlit iron, a testbar, 1¼ in. dia., was taken and a length of about 1 in. in the centre of the bar was turned down to 1.000-in. dia., namely, 0.7854 sq. in. area. It broke at a load of 12.68 tons, thus having a tensile strength of 16.14 tons per sq. in. On examination it was found that the bar was slightly flawed.

Another testbar was turned, from the top-half of the above bar, to a diameter of 0.803 in.; area, 0.5064 sq. ins. This broke at 9.06 tons load, namely, a tensile strength of 17.89 tons per sq. in. The bottom half of the original bar was then turned to a diameter of 0.565 in. (area, 0.2506 sq. in.), and broke under a load of 4.25 tons, thus giving a tensile strength of 16.98 tons per sq. in.

The analysis of the above bar was total carbon, 3.21 per cent.; combined carbon, 0.74 per cent.; and silicon, 0.81 per cent., and that the transverse strength of two companion bars (tested as

cast between 12 in. centres) was 4,049 lbs. and 3,891 lbs., with deflections of 0.197 in. and 0.143 in. respectively.

Another test of this nature was made by casting three bars of 2.7 in. dia. and turning them to the following diameters respectively, 1.135 in., 0.798 in., and 0.566 in., the results being as follows:—

Diameter Ins.	Area Sq. Ins.	Gauge Length Ins.	Load Tons.	T.S. Tons Sq In.
1.135	1.012	3½	13.48	13.32
0.798	0.500	3	6.30	12.60
0.566	0.2516	2	3.27	13.00

It should be noted that these bars were rather high in silicon and carbon; better results would be obtained, nowadays, in the light of present experience.

In order to test the "spring" of Perlit piston rings after final machining, the gap was measured. Then the ring was forced on the piston in the usual manner and removed, the gap again being measured. This forcing on the piston and removing was continued until the gap no longer increased in size, the results being as follows:—

Gap before test			2.1 in.
Gap after 1st	time	on piston	3.1 ,,
,, 2nd	,,	,,	3.15 ,,
,, 3rd	,,	,,	3.20 ,,
,, 4th	,,	,,	3.25 ,,
,, 5th	,,	,,	3.25 ,,

thus giving a total increase in gap of 1.15 in.

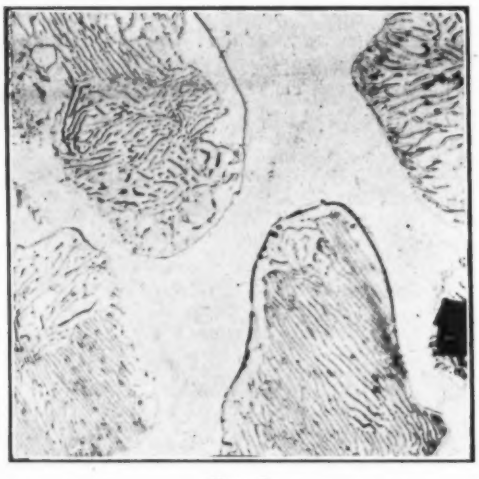


FIG. 7.

(FN 1052) Photograph of Pearlite (lamellæ) and Cementite (white) in a sample from which Figs. 5 and 6 were taken. × 400 diameters.

Regarding the behaviour of Perlit piston rings in marine work, the author has obtained permission to publish a letter sent by a chief engineer on the arrival of his ship at Melbourne. This reads as follows:—

"On opening up No. 2 dynamo cylinders, we found the 'Perlit' rings in very good condition and showing a complete bearing surface; also the cylinder somewhat improved. I am of opinion that excellent results would be obtained with this ring fitted in a newly-bored cylinder with good-fitting piston head."

Also he appends the following figures:—
Total number of hours run, 856.
Thickness of rings, top, $\frac{7}{16}$ in.; bottom, $\frac{7}{16}$ in.
Opening of butts, top, $\frac{1}{16}$ in.; bottom, $\frac{7}{32}$ in.
Opening of butts when fitted, $\frac{3}{32}$ in.
Diameter of cylinder, $7\frac{7}{8}$ in.
Diameter of piston head, $7\frac{3}{4}$ in.

The resistance to impact of iron made under Perlit conditions is very remarkable. The machine used for this test had a tup weight of 4.185 kgs., dropping through a distance of 1 cm.; the bar being turned half-way round after each blow, and the machine delivering 88-89 blows per minute. Over a large number of tests it was found that ordinary good cylinder metal and ordinary good cylinder-liner metal broke after a number of blows ranging between totals of 384 and 644, while good bedplate irons ranged between 159 and 229 blows.

The Perlit irons, on the other hand, when tested in bars of similar casting size to ordinary ones, ranged between 1,340 and 3,035 blows. It is remarkable, also, that bars cut out of great thicknesses, such as 6 in. in casting heads, withstood between 3,000 and 4,000 blows.

The size of the bars used on this machine is:—100 m/m. between supports, 15 m/m. diameter, with a curved notch 5 m/m. wide, and 13 m/m. at its minimum diameter.

Some ¼-in. thickness plates were made, and, as the foundry concerned was accustomed to heavy work only, such a thin casting was a difficult proposition. The photographs of this metal have considerable interest, however, and are shown in Figs. 8 and 9.

They are representative of the metal as a whole, the analysis being:—Total carbon, 3.43 per cent.; combined carbon, 0.90 per cent.; and silicon, 0.96 per cent. It will be noted that such thin plates could be made of half-a-dozen different qualities of Perlit, high or low silicon or carbon, according to the purpose for which it is intended.

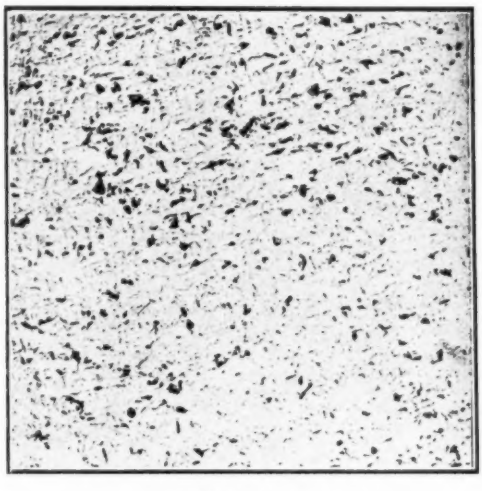


FIG. 8.

(FN 989) Graphite in Perlit plate of ¼-in. casting thickness. × 25 diameters.

A bush-casting, made of a softer type of Perlit, of casting thickness of 1½ in., contained 0.7 per cent. combined carbon throughout, with 2.5 per cent. of graphite, and silicon, 0.68, and gave the following tests:—

Tensile Tons sq. in.	Transverse Lbs.	Deflection Ins.	Impact Blows	Crushing Tons sq. in.	Angle of Fracture	Brinell	Sclero-scope
14.82	3017	0.236	1829	50.14	48°	170	25
			1412	49.01	55°		
13.54	3017	0.246	1396	49.40	57½°		
			1344				

Testbars have been cut out of the "casting-heads" of main engine pistons. This casting weighs about 2 tons, and has casting thicknesses from 1¾ in. to 3 in., is very complicated, and used for double-acting Diesel engines of 1,000-h.p. per cylinder. The casting thickness of the metal, from where the testbars were cut, is about 6 in. The silicon content is about 0.4 per cent. The results from castings, cast on various dates, are on the following lines:—

Casting No.	Tensile Tons sq. in.	Transverse on 1" sq. bar, 12" between supports	Deflection	Brinell	Repeated impact
50	15.24	3374 lbs.	0.216	—	3624
53	15.32	3255 lbs.	0.236	183-198	—
59	14.54	2978 lbs.	0.177	197	—

Similar testbars are taken from 6-in. thicknesses of metal in the casting heads of Diesel cylinder bottom covers, the castings weighing about 3 tons and having thicknesses from 1 in. to 5 in. The silicon content is about 0.4 per cent.

52	13.0	2620 lbs.	0.177
55	13.4	2759 lbs.	0.177
61	13.22	2620 lbs.	0.177

Another complicated Diesel casting made from metal of similar silicon content is the cylinder head, which weighs about 5½ tons, has about 25 cores in the mould, and contains thicknesses varying from 1¼ in. to 4 in. The testbars are cut from about 5½-in. casting thickness of the "head" of the casting.

Casting No.	Tensile	Transverse	Deflection	Brinell
52	16.0	2779 lbs.	0.187	—
53	14.9	2660 lbs.	0.167	179-187
55	15.3	2660 lbs.	0.216	187
59	13.9	3295 lbs.	0.162	197
63	16.7	3414 lbs.	0.216	187

Testbars are cut also from the casting heads of Diesel combustion chambers (casting thickness 1 in. to 6 in., weight of casting 30 cwts.), which "heads" are about 2½-in. casting thickness, and are not large enough to allow of transverse testbars being obtained.

The silicon content is about 0.8 per cent.

Casting No.	Tensile.
44	15.86
50	15.54
57	15.44
63	14.12

A light casting, in the shape of the combustion-head of a famous motor-car, was cast of metal of about 1.5 per cent. silicon. The weight of this

FIG. 9.

(FN 992) Graphite (black), Pearlite (lamellæ), and Sulphide (half-tone) in Perlit plate of ¼-in. casting thickness. × 1,500 diameters.

casting was about 40 lbs., and the casting thickness varied from ⅜ in. to 1¼ in. The moulds were made by a foundry accustomed to this type of work, and with no alteration in either their sands or their core oil, and it is interesting to note that in no case did either the sand or the oil cause trouble, this in spite of the fact that the moulds were heated up to the neighbourhood of 450 deg. C.

It has been demonstrated to the satisfaction of the author that the Perlit procedure is applicable to all classes of foundry practice, and that success depends upon the skill of the moulder and of the metallurgist in the same degree as it attends the manufacture of castings of all other alloys and of steel.

To conclude this Paper, the author desires to draw attention to a matter which, so far as he is aware, has been overlooked, namely, the question of grain-size.

In an ordinary grey-iron casting the grain-size varies from section to section and throughout each section, but its significance has been lost owing to the growth of graphite and the sparkling effect produced by it in the thicker sections and in the centres of sections. Let it be understood, therefore, that in speaking of large grain-size, the author refers to iron of close tight fracture and where the Cook-Hailstone network has large meshes. Some two or three years ago the author did some work upon the corrosion of cast iron in very dilute $\left(\frac{N}{100}\right)$ hydrochloric acid. Series of cast irons were selected of similar casting thickness, each series varying only in one constituent. There are about 15 irons in each series and in 5 series, namely—carbon, silicon, phosphorus, sulphur, and manganese. The samples, about 150 in all, were immersed simultaneously in the bath, and the experiment arranged so that any variation of conditions affected all the samples.

It may be added that in these experiments each sample was present in duplicate, which duplicates were far apart from each other in the bath.

From the results of the first experiment in the weak hydrochloric acid, it was deemed essential to do another one in sea water, the bath being charged with fresh sea water once every week. Whereas the acid test lasted for 195 hours, the sea-water test lasted for 26 weeks. From the mass of data obtained came the information that the corrosion of grey cast iron in very dilute hydrochloric acid, or in sea water, is not affected by variation of total carbon between 3 and 3.6 per cent., or by sulphur varying between 0.09 and 0.25, or by manganese varying between 0.4 and 1.40 per cent. It was proved that corrosion is hastened by increase of phosphorus (the samples under test varying from 0.04 up to 0.25 per cent.); also hastened by increase of silicon (the experiments being done on irons varying from 0.80 and 2.45 per cent. silicon), and, finally, is hastened by decrease of grain-size, namely, casting thickness.

The latter information was so interesting that an additional experiment was made on grain-size only, all other factors being constant, and it was proved, beyond doubt, that the greater the casting-thickness the less is the corrosion as compared with the same iron at lesser thicknesses.

These tests were done before the introduction of the Perlit process in the works concerned, but we have now discovered that the grain-size of Perlit is larger than that of ordinary cast iron; which is, of course, logical because of the uniform method of cooling throughout each section and the lack of chilling on the outside areas.

Other workers in cast iron will be aware of the fact that its resistance to wear is affected by casting-thickness, and it is impossible to obtain comparable results from testbars (cast as such) such as will represent the behaviour of, say, the wall of a large cylinder-liner. Rightly or wrongly, the author has considered always that the wearing properties of large castings were superior to the small-grained metal obtained in the testbars supposed to represent those castings. In any case, we have ample evidence now that not only is resistance to heat better in irons of low silicon, low phosphorus content, but also resistance to corrosion.

Tests are being conducted by eminent research workers upon the "growth" properties of Perlit irons, and the author has received letters saying that Perlit is showing very favourable results.

In this Paper it is endeavoured to place before engineers the latest practice in cast iron and to sum up the present position. Certain other claims have arisen recently, and are based apparently upon Diefenthaler's principle and practice. Iron of any one composition has its ideal cooling rate, whilst irons of any other compositions will have other ideal cooling rates, all of which must be considered in conjunction with the composition, mass, and casting-thickness, in order to attain homogeneity in a casting.

The author desired to thank Mr. Summers Hunter, the North-Eastern Marine Engineering Company, and Messrs. Alfred Holt & Company.

Belgian Foundrymen's Association.

Mr. Paul Ropsy, Managing Director of the Belgian Griffin Company, of Merxem, Antwerp, has been elected President of the Belgian Foundrymen's Association. Mr. Jean Lamoureux, of the S.A. des Ateliers Lamoureux, Liege, and Mr. J. Varlet, foundry manager to the S.A. Metallurgique d'Espérance-Langdoz, Schlessin, are the new vice-presidents, whilst Mr. Ledent, of Angleur, is the secretary, with Mr. L. Foulon, Liege, assisting him. Mr. G. Masson (past-president) and Mr. L. Piedboeuf are *inter-alia*, to serve as councillors.

Are Small-Quantity Orders Worth Having?

By W. J. HISCOX.

In the matter of securing orders some foundries are much more fortunate than others, for they receive the inquiries of the factories engaged upon repetition manufacture, and the quantity of castings ordered to one specific design is pretty substantial. This, of course, makes for economy and cheapness, and the price at which the castings are sold is usually satisfactory alike to the buyer and the producer.

The two branches of engineering which to-day appear to be thriving are those devoted to automobiles and to electrical products, and in both instances "quantity production" is the rule. From the foundry standpoint this is all to the good, but in spite of the prominence these two branches enjoy, they do not in themselves keep the whole foundry industry fully employed. There are many other branches of engineering (lesser known than the two mentioned) which are at the present time in a fairly healthy condition, and these also have to depend upon the foundry for essential features of their products.

That these branches of engineering are not assiduously courted by the foundry industry is due to the fact that their wants, although somewhat large, are very wide in range, and this means a greater variation and consequently smaller requirement of castings to any specific design. Instead of orders being received for, say, 500 castings, with repeat orders every three or four months, fives and tens are the extent of the requirement, and with very little likelihood of repeat orders following.

This would not be so bad were the castings easy to produce and substantial in weight, but usually the production is somewhat intricate, whilst the aggregate weight of the ten castings covered by one order is not more than a dozen or so pounds. The buyer of these castings expects to get them at what he considers a reasonable figure, but his idea of a reasonable figure is often at variance with that of the foundryman—consequently there is no great eagerness on the part of the latter to accept such orders.

Yet it is obvious that they must be accepted, and, in point of fact, the foundry industry cannot do without them. The buyer of these castings is usually in a comparatively small way of business (large perhaps as regards his own particular product, but small when compared with engineering factories generally), and he is not in a position to pay fancy prices for his commodities, although he appreciates that the prices must necessarily rule higher than in the case of quantity production. His requirement is too small to warrant the establishment of a foundry of his own, and so he is compelled to rely upon outside resources.

It was said at the beginning of this article that some foundries are more fortunate than others, and the fortunate ones are those who secure orders for large quantities, even though these orders are secured in the face of keen competition. Even though the price be low, it is always possible to effect economies when quantity production rules, but it is much more difficult when the quantity is smaller and there is greater variation.

Many of those foundries which secure orders on a quantity production basis do not trouble at all about the smaller specialised orders, but others are not averse to reserving a corner for them, believing that all is grist that comes into the mill. They do not go out of their way to secure such orders, but when invited to quote they will do so, and often they secure the order by reason of a relatively low quotation. It need not be inferred from this that the policy adopted is that of making up on the swings what is lost on the roundabouts, or, in other words, making quantity production pay for specialised orders, except in the sense that specialised orders can be quoted lower by means of the improved organisation necessary to the foundry engaged for the most part in quantity production. The specialised orders are in such a foundry a paying proposition, the lower selling price being made possible by improved facilities.

The disadvantage under which the buyer labours is that he can very rarely depend upon delivery, for specialised orders are regarded as a convenience, to be pushed forward or held as the circumstances demand. To enable the specialised orders to become a paying proposition it is obvious that the castings must be "worked in," the smaller ones being used to fill in odd corners. The buyer, when he realises this, is constrained to forgo the lower price asked by such a foundry, and place his orders elsewhere at a somewhat higher figure, but where he can depend upon delivery.

There is a tendency on the part of some buyers to place their orders for large castings with a foundry doing a volume of repetition business, and the small ones with a foundry more or less engaged on specialised work. This is really unfair to the latter foundry, unless it is proved that it cannot undertake the work. If the buyer is satisfied with the work of a foundry in connection with his small work, he certainly ought to give that foundry the first opportunity of handling his larger castings, even if the price quoted is somewhat higher. One foundry manager called at the works of one of his customers and saw three large patterns on the point of being despatched to another foundry. He had for some time been executing orders for small castings in a manner satisfactory to his customer, and was under the impression that no large castings were associated with his customer's product. Consequently he was very much surprised to see large patterns going elsewhere, and spoke very strongly upon the subject. As a result, he was invited to quote for the larger castings; his figure was precisely that of the other foundry, and he received the order. The quality of the castings supplied was equal to that of the other foundry, whilst his deliveries were much more satisfactory.

The small-quantity buyer is restricted in his choice of a foundry by reason of prohibitive railway charges, and for this reason he has to place his orders with foundries in the vicinity of his factory. If the foundry will undertake delivery, he can go further afield, but it is obvious that there must be a sufficient number of castings on order to justify a delivery being made. If the foundry is catering for a number of small buyers in adjacent districts it would perhaps be possible to make up a load so that deliveries could be made twice weekly, which would be satisfactory to all parties. The founder should always advise his customers when a delivery is about to be made, so that any returns, such as patterns or rejects, can be made ready.

The advantages of having a number of customers in adjacent districts should not be overlooked by the foundryman, who would do well to make a list of the manufacturers interested in castings, and endeavour to secure at least a part of their business.

There is a vast number of the small buyers in London, and that number is increasing. As mentioned earlier, the electrical and automobile industries alone will not keep the foundries fully employed, and business with the smaller buyer is not to be despised. It may be true that the same margin of profit is not secured as in the case of quantity production, and it is undoubtedly true that the more variation the greater amount of trouble there is in the foundry. On the other hand, there is not so much competition in connection with specialised orders, and if the foundry is laid out to cater for such work, there is no reason why the selling price of the casting should not yield a fair margin of profit.

The buyer, for his part, would do well to look ahead, and calculate his probable requirements with a view to placing orders for the largest possible quantities. One order for 50 castings is much better than five orders covering 10 castings each, spread over a period and with gaps in between. If, over a period of six months, a buyer places five different orders for a similar casting, it is evident that his organisation wants attending to, for he should be able to calculate fairly accurately his requirements six months ahead. In concluding, it is emphasised that these small orders are worth having, and that the foundryman who is long-sighted and keen upon extending his business will make a determined effort to capture them—going after them instead of waiting until they are brought to him.

"Shrink" in Black-Heart Malleable.

By Christian Kluijtmans, B.Sc., M.A.T.F.

There are two kinds of "shrinks." (1) Those filled up with iron and showing in the centre of the section a granular area surrounded, in white iron, by large crystals, as shown in Fig. 1; and (2) those showing a hole and as a rule surrounded by a rim of granular iron, as illustrated in Fig. 2.

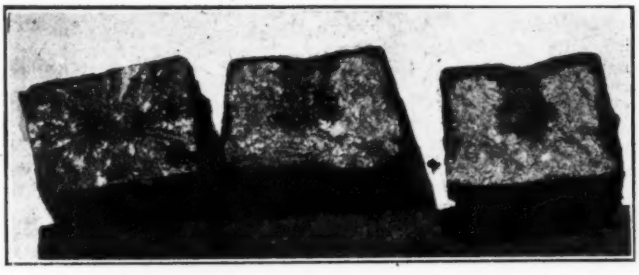


FIG. 1.—FILLED-UP "SHRINK."

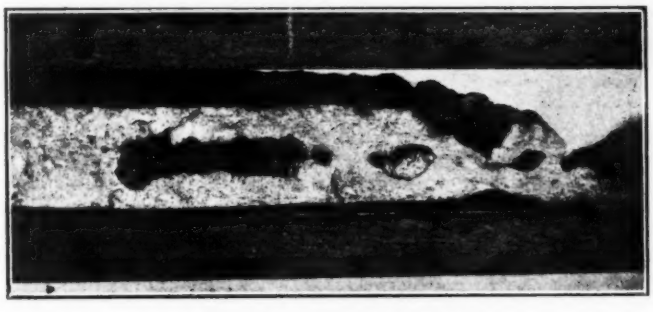


FIG. 2.—HOLLOW "SHRINK."

Filled-up Shrink.

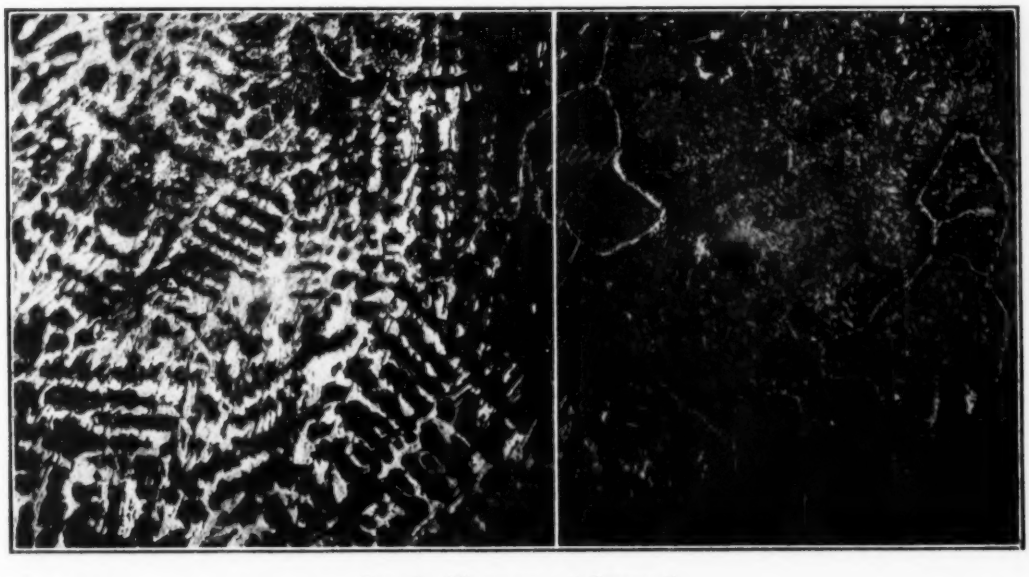
To be clear on this question, reference must be made to the mechanism of solidification, wherein the following tenets have been established:—(*a*) Liquid iron contains carbon in the form of a solution of iron carbide (Fe_3C) in iron; (*b*) when solidifying Austenite, which does not contain more than 2.20 per cent. of carbon as carbide is first to separate out.

Next, the remaining portion to solidify, which is more fluid, contains never more than 4.30 per cent. of carbon and corresponds to the eutectic cementite, and is a mixture of Austenite and carbide.

Cooling through the range 1,130 deg. C. down to 700 deg. C., the Austenite loses a part of its carbide and retains only 0.90 per cent. of carbon, and is the "eutectoid," or "pearlite."

From the above it should be noted that Austenite is the last to react, rejecting nearly all its carbon, as carbide, to remain as pearlite. Being the last formed, it remains in the liquid state or semi-liquid state through the critical range for a longer time.

When the carbon content is about 2.20 per cent. or below, the proportion of pearlite and the



White Iron. Shrink.

FIG. 3.—MICRO OF A "SHRINK."

chance of having "pearlitic area" are greater. On the other hand, for the same carbon content and the thicker the section, the larger will be the pearlitic area, and inversely.

The thicker the section, the higher must be the carbon content, so as to reduce the chance of having pearlitic areas; or, again, the pearlitic area is inversely proportional to the carbon content, a carbon content of 2.30 per cent. is rather a low figure, although high in silicon, and the founder would obviously fear making numerous misrun castings.

In general it is laid down that the thicker the casting the lower the carbon content to prevent primary graphite. Again, this theory does not conform with the "size of the secondary graphite"

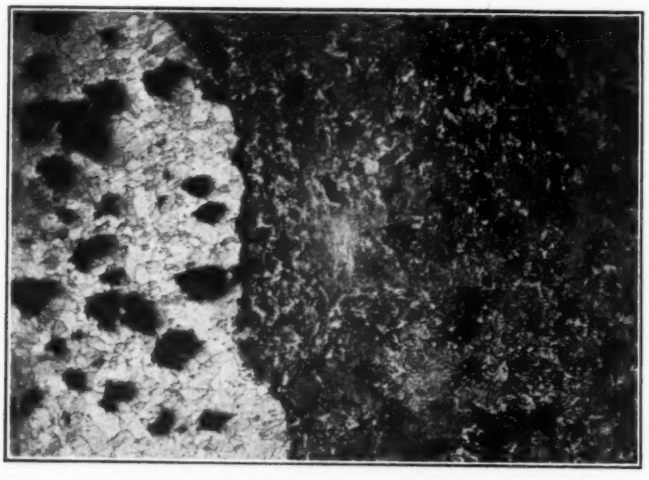


Fig. 4.—White Iron after Annealing Graphite-Black Ferrite as Crystals.

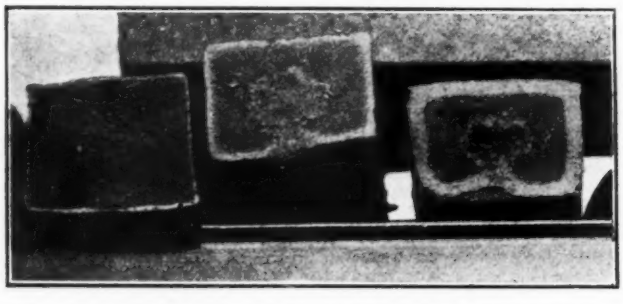


Fig. 5.—Annealed Samples of the Iron shown in Fig. 1.

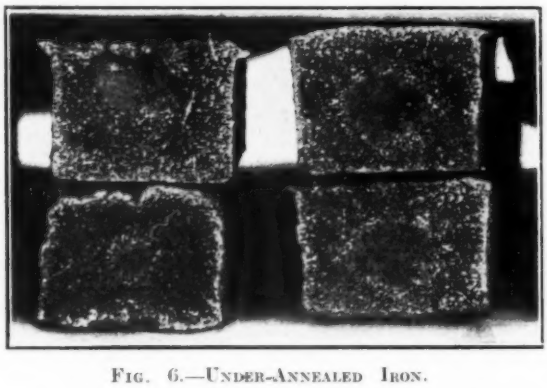


Fig. 6.—Under-Annealed Iron.

to the thickness of casting and the rate of cooling.

To conform with the above theory, the carbon and silicon content should be as set out in Table I.

Table I.—*Relationship of Thickness to Chemical Composition.*

Thickness.	C. per cent.	Si. per cent.
½"	2.30	1.00
¾"	2.40	0.90
1"	2.60	0.70
2"	2.80	0.60

These figures give the permissible limits commensurate with the avoidance of primary graphite with sections of castings over 1 in. thick.

Of course, this theory does not agree with general practice, because for castings of ½ in. thick idea, as it is established that the larger the cementite the larger will be the nodules of secondary graphite.

This is obviously a difficult problem, and that is why "shrink" troubles still exist, as they act contrarily in practice.

That a "filled-up shrink" is a pearlitic area surrounded with carbide of iron is confirmed by the nature of fracture in the white iron (Fig. 1), which shows in centre a granular portion varying in colour from bright steely, straw, purple, blue. These colours are due to internal cracks permitting the air more or less to penetrate.

The micro, Fig. 3, shows the boundaries of a shrink as cast. On one side is the white iron with the massive cementite (white), but as the other side is approached the cementite becomes scarce,

and forms a network of thin cementite filled up with and surrounded by pearlite.

On annealing, the pearlite will not be decomposed as ferrite and graphite, but will only grow in size as shown in the micro, Fig. 4, one side of which is the white iron properly annealed, and next to the abrupt demarcation there is the "pearlitic area." This is soon detected by the nature of fractures, as shown in Fig. 5, which are the same samples as Fig. 1, but which have been annealed. After annealing, the shrink will appear

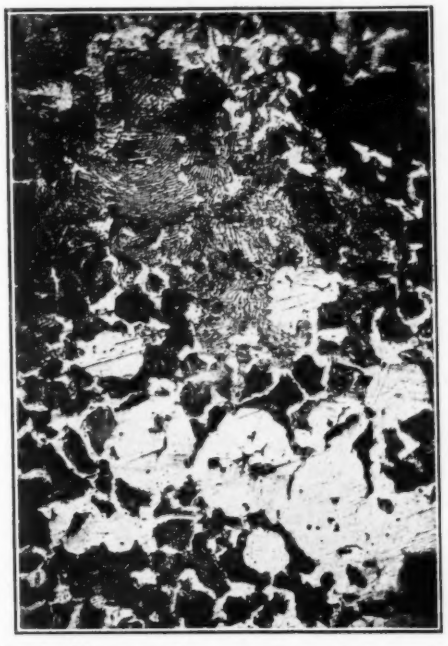


FIG. 7.—MICRO OF UNDER-ANNEALED IRON × 100.

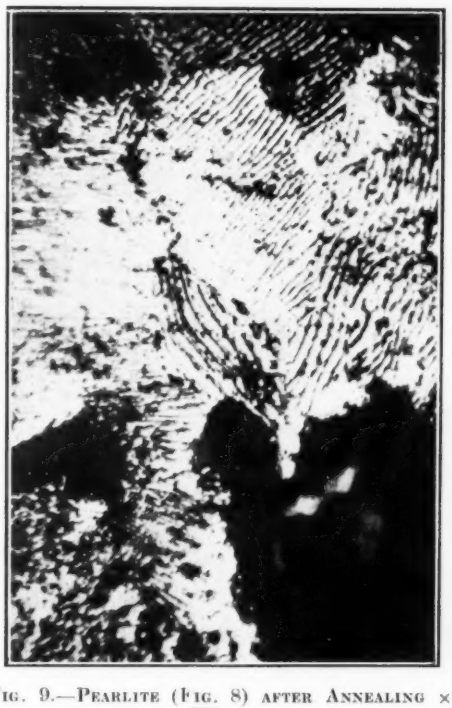


FIG. 9.—PEARLITE (FIG. 8) AFTER ANNEALING × 300 DIAS.

either bright steely, straw, purple or blue, depending on the size of the internal cracks.

A shrink could be defined as an annealed steel surrounded by blackheart malleable iron. The above, however, must not be confused with under-annealed iron, which shows a spotted fracture (Fig. 6), while the microstructure shows a partly decomposed cementite, as in Fig. 7, where there are found together graphite (black), ferrite (white crystal), sorbitic pearlite (round white grains) and lamelar pearlite (as a finger print).

Hole Due to the Shrink.

This case is rather difficult to detect with the naked eye, because it might be confused with a blow hole. A shrink hole has a rough surface, and is bright in colour, but if the section is slightly cracked on this pot the shrink hole may have all sorts of coloration from straw up to grey, depending on the volume of air entered.

Under the microscope it is quite different; as a shrink hole it is at once detected either as cast or after annealing.

A shrink hole is always surrounded by pearlite as shown in Fig. 8, and follows the rule enunciated in the first paragraph.

After annealing, pearlite is opened as shown (Fig. 9).

The influence of a shrink on the physical properties is well known; it reduces the elongation to a great extent. A shrink has no importance with cupola malleable, as the structure after annealing is pearlitic in the centre of the casting up to $\frac{1}{2}$ in. section.

FIG. 8.—SHRINK HOLE SURROUNDED BY PEARLITE × 100.

Thinner castings being almost decarburised, the shrink is destroyed by the removal of the carbon.

All the micros reproduced are etched with 5 per cent. HNO_3 in alcohol, and are at 100 dias., except No. 9, which is magnified 300 times.

SIR GEORGE RENWICK has invited the members of the Society of Chemical Industry, the Institute of Chemistry, and the Newcastle Chemical Industry Club to visit his residence, Newminster Abbey, Morpeth, on Saturday, August 7.

AN AMALGAMATION is announced between the Central Steel Company of Massilon and the United Alloy Steel Corporation of Canton, Ohio, U.S.A. The new company, which will be known as the Central Alloy Steel Corporation, has assets exceeding $80,000,000 (say £16,500,000).

THE MANAGEMENT of the Austrian Alpine Montan Company at Donawitz reports that it will be compelled in the near future to restrict considerably the output of their iron and steel works and rolling mills at Donawitz, and also of the outputs of iron and coal at their mines. Their rolling mills at Donawitz are working short time since July 19. The next step will be to blow out a blast furnace and keep only one going, and to further reduce the rate of working of the steel works and rolling mills.

XUM

Trade Talk.

THE FIRM OF Henschel & Sons, at Cassel, Germany, has secured an order for 50 locomotives for South Africa.

THE SOUTHERN FOUNDRIES at Waddon, Croydon, which closed down last week in consequence of lack of fuel and material, have now made a partial resumption.

R. & W. HAWTHORN, LESLIE & COMPANY, LIMITED, Newcastle-on-Tyne, intimate the removal of their London office from 3A, Dean's Yard, to 54, Victoria Street, S.W.1.

CONTRACTS for twenty locomotive boilers have been divided by the New Zealand Government Railways between Robert Stephenson & Company, Limited, and the North British Locomotive Company, Limited.

THE WHESSOE FOUNDRY COMPANY, in order to keep their works going, have placed an order for 3,000 tons of steel plates on the Continent which would normally have been manufactured by Tees-side rolling mills.

AN ASCERTAINMENT of the selling price of steel tinplate bars for the last quarter made known at Swansea gives the figure of £6 0s. 8¾d., and this involves no change in the sliding scale percentages of steel workers' wages for the next three months.

THE CENTRAL MARINE ENGINE WORKS of Wm. Gray & Company have closed for a fortnight, and Richardsons, Westgarth & Company's Hartlepool Engine Works for three weeks. Messrs. Gray & Company's Central Shipyard is also closed, all for want of fuel.

SIR WM. ARROL & COMPANY, LIMITED, have an order from the Crown Agents for the Colonies for a 50-ton floating crane. William Bain & Company, Limited, are supplying the War Office with steelwork of new workshops to be erected at Longmoor Camp, Hants. Orders for 10,000 tons of 70-lb. steel rails and fasteners for use in the New Zealand railways have been placed with the British Empire Steel Corporation of Montreal.

THAT MANY FIRMS are taking the opportunity of the slackness during the coal strike to modernise their foundries is indicated by the orders which have been received by the Constructional Engineering Company, Limited, of Titan Works, Birmingham, recently. This firm has in hand new complete melting equipment consisting of two 6 ft. 6 in. diameter cupolas, fan and motor, cupola charging gear, special ladles, etc., for the Falkirk Iron Company, Limited, Falkirk; for the Excelsior Foundry Company, Sandiacre, 5 ft. diameter cupola, charging platform, electric hoist, etc.; for Newton, Chambers & Company, Limited, Thorncliffe Ironworks, Sheffield, two 4 ft. diameter cupolas, spark arresters, fan and motor, etc.; for Brown & Green, Limited, Luton, two 5 ft. diameter cupolas, spark arresters, fan and motor, etc. (repeat order); also a 4 ft. 6 in. diameter cupola, staging, fan and motor, for Aberdeen. This brings the total number of users of "Titan" cupolas to practically 1,300.

Company Reports.

Aluminium Corporation, Limited.—Profit, £53,743; brought forward, £23,990; debit balance, £13,734 carried forward.

Wellman Smith Owen Engineering Corporation, Limited.—Trading loss, £4,294; taxation, £3,579; credit balance brought into accounts reduced to £10,971, and carried forward.

Vickers, Limited.—Interim dividends for half-year ended June 30, 2½ per cent. on preferred 5 per cent. stock, less tax; 2½ per cent. on 5 per cent. preference shares, less tax; and 2½ per cent. on cumulative preference shares, free of tax.

Warner & Company, Limited.—Profit, £15,785; appreciation in value of investments, £396; brought in, £2,508; available, £18,689; income tax, £2,521; depreciation, £1,000; final dividend on ordinary, 17½ per cent., making 22½ per cent. less tax, for year, plus bonus of 1s. 6d. per share, also less tax; forward, £3,058.

New Companies.

H. P. Adana, Limited, 4, York Street, Twickenham.—Capital £500 in £1 shares. Ironfounders. Directors: D. A. Aspinall and E. C. Savage.

J. Pemberton & Sons (Metals), Limited.—Capital £1,000. Metal brokers. Subscribers: R. Bramley and J. Pemberton, both of Leeds.

Margreidon, Limited.—Capital £1,000 in £1 shares. Dealers in iron. Directors: E. L. Davies, 1A, Herbert Road, Plumstead Common, S.E.18; E. J. Burrows, 29, Lyndhurst Road, Highams Park, Chingford, E.5.

Personal.

MR. J. BIRD has retired from the board of J. Samuel White & Company, Limited.

MR. W. FORBES, of Strathspey, Troon, has been elected a director of Stewarts & Lloyds, Limited.

MR. H. STEVENSON has been elected chairman of Allen-Liversidge, Limited, in succession to the late Mr. C. S. Gilman, J.P.

MR. A. CARTWRIGHT has been elected a director of Vickers, Limited. Mr. G. G. Sim has been appointed secretary of the company.

MR. W. G. C. NIXON has been elected president and Mr. P. M. Anderson and Mr. F. G. A. Roberts vice-presidents of the South African Institute of Engineers.

MR. CHARLES M. SCHWAB, chairman of the Bethlehem Steel Corporation, has been nominated as the president of the American Society of Mechanical Engineers for 1927.

MR. R. W. MAUDSLAY has been elected president of the Society of Motor Manufacturers and Traders for the current year, with Sir George Beharrell and Mr. G. M. Young as vice-presidents.

MR. J. DICKSON, late of the Mitcham Foundry Company, Limited, is no longer associated with W. E. Horsman, Son & Company, Mitcham Foundry and Iron Works, Eveline Road, Figgs Marsh, Mitcham, Surrey, at which works he held the position of foundry manager.

MR. GEO. G. SIM, who, as we have already reported, has been appointed secretary of Vickers, Limited, has a long association with the Indian Civil Service. He was born at Strichen, Aberdeenshire, in 1878, and was educated at the University, Aberdeen, and Christ Church, Oxford. He entered the Indian Civil Service in 1901, and served in the United Provinces as Assistant Magistrate and Collector. He was Under-Secretary to the Government in 1908-10, chairman of the Cawnpore Municipal Board 1912-17, Financial Secretary to the Government of the United Provinces 1917-20, on special duty in the Finance Department of the Government of India in 1920, Joint-Secretary of the Finance Department of the Government of India in 1921, and a member of the Board of Inland Revenue in 1922, since when he has been Financial Commissioner (Railways), Government of India.

SEVERAL important additions to the board and changes in the management have been made by Sir W. G. Armstrong, Whitworth & Company, Limited. Three new directors have been added: Mr. J. D. Siddeley, managing director of Armstrong Siddeley Motors; Mr. James Hawson, Edinburgh, lately vice-president and director of Algoma Steel Corporation and other companies; Mr. J. P. Davison, general sales manager, Sir W. G. Armstrong, Whitworth & Company, Limited. The following changes in the management of the company are announced: Mr. J. Frater Taylor becomes vice-chairman of the board and chairman of the executive committee; Mr. J. D. Siddeley becomes managing director (senior) and chairman of the committee of management, and will give his special attention to the manufacturing end of the business; in addition, in order to make the shipbuilding branch of the business self-contained, a management corporation has been formed, of which Sir Eustace Tennyson d'Eyncourt, late Director of Naval Construction, will be chairman, and Mr. James Stewart, shipbuilder, will be managing director.

Wills.

STEVEN, J., of Fernlea, Seamill, West Kilbride, Ayrshire, brassfounder	£51,684
BUTTERWORTH, T., of Butterworth & Dickinson, Limited, engineers	£68,700
BAXTER, A., of Wemyss Park, Blairhill, Coatbridge, iron merchant	£7,119
GRAHAM, E. A., electrical engineer, of Alfred Graham & Company	£140,536
NEWTON, G., J.P., a director of the Southport Engineering Company, Limited ...	£33,626
ORTON, J., of Barnstaple, formerly carrying on the Melbourne Iron Works, Willenhall, near Wolverhampton	£6,435
MUSGRAVE, J., of Nile House, Vulcan Lane, Workington, Cumberland, proprietor of the Nile Foundries	£12,743
JONES, C., of Oakfield Road, Sheffield, managing director of J. Grayson, Lowood & Company, Limited	£6,232
RITCHIE, K. L., of Grove Hill, Middlesbrough, a director and commercial manager of James and Ronald Ritchie, Limited	£21,669
GODDARD, F., lately chairman of Birchells Furnaces and of the Denby Iron and Coal Company, and a director of the Wolfram Mining and Smelting Company	£32,430

SUPERIOR OUGHTIBRIDGE
GANISTER
ALSO "SILCO-SILICA" BRICK LININGS FOR CUPOLAS. CONSIDERED SUPERIOR TO FIRECLAY.
THE OUGHTIBRIDGE SILICA FIREBRICK CO., LTD.
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LADLES, FIRE BRICKS, STONE FLUX, CASTING CLEANERS, PIPE NAILS, SPRIGS, WIRE BRUSHES, BELLOWS,
CUPOLAS, GANISTER, LOAM AND SAND MILLS, STUDS, CHAPLETS, BRUSHES, CORE ROPES. BUCKETS, SPADES, Etc.

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COLTNESS IRON CO., LTD.
Makers of the well-known and old-established
"COLTNESS" BRAND OF HIGH CLASS SCOTCH PIG IRON
FOUNDRY. No. 1, No. 3, No. 4. } STANDARD GRADES { HEMATITE. No. 1, No. 3, No. 4.
Works:— Newmains, Lanarkshire.
PRICES, ANALYSES, ETC., MAY BE OBTAINED ON APPLICATION TO THE GLASGOW OFFICE.
Office:— 75, Bothwell St., Glasgow, C.2.

IRON AND STEEL MARKETS.

Pig-Iron.

MIDDLESBROUGH.—With the annual summer holiday now at full tide, industrial operations throughout Tees-side are completely suspended, and markets are meantime necessarily suspended. The outlook for the current month points, consequently, to general inactivity, makers with idle furnaces having little inducement to offer on forward account, while the small amount of foundry qualities available is currently quoted as follows:—No. 1, 92s. 6d.; No. 3 G.M.B., 90s.; No. 4 foundry, 89s.; and No. 4 forge, 88s. 6d. per ton.

There is no change in the hematite position, though, if anything, the tone is somewhat firmer. There is very little hematite now being made, and stocks have been considerably reduced during the strike period. For East Coast mixed numbers, about 81s. per ton is now named, and for No. 1 81s. 6d. per ton. On the North-West coast, prices are firmer, Bessemer mixed numbers being quoted at £4 4s. per ton c.i.f. Welsh ports; £4 7s. 6d. per ton delivered at Glasgow; £4 9s. 6d. to £4 11s. 6d. per ton delivered at Sheffield; and £4 17s. 6d. to £5 ton delivered at Birmingham.

LANCASHIRE.—In this area, for foundries that are prepared to pay the figures that are being asked for pig-iron now, there are still small lots to be picked up, although there are complaints in some cases on the score of quality of some of the parcels that come on to the market. For Scottish No. 3, quotations now rule from 99s. 6d. to 102s. 6d. per ton, delivered Manchester, and Middlesbrough No. 3 has also been offered at round the latter figure.

THE MIDLANDS.—Throughout South Staffordshire and the adjacent districts, it is still possible to get supplies of No. 1 Middlesbrough for early despatch at about £5 8s. to £5 10s. per ton delivered sidings or local stations. No. 3 grade of this iron is also offered for August delivery at about 3s. per ton less. There is also a small quantity of Shropshire "all mine" still on the market, for which the price is round about £5 5s. delivered here. Limited supplies of Scotch No. 3 foundry iron are also on offer at the same price.

SCOTLAND.—The Scottish pig-iron markets remain very quiet, as many of the works are still closed for the holidays. However, in spite of the quietness, prices are very firm, as iron daily becomes scarcer and the prospect of furnaces going into blast again is still uncertain. No. 3 foundry can still be got at 82s. 6d. f.o.t. furnaces, but in some cases 86s. is being asked, and even at that figure only limited parcels are being offered.

Finished Iron.

As previously noted, there are few manufacturers now producing this class of material, and in South Staffordshire the only business developing is in connection with Continental nut, bolt and fencing iron. There has been no alteration in the price of this product, which has been offered at about £5 17s. 6d. per ton delivered works in this locality There is still a fair amount of business accruing, and delivery is promised by the French and Belgian works in September. It is a matter of conjecture what the prices of Staffordshire crown and marked bars will be after resumption.

Steel.

At Sheffield the steel market is extremely quiet, but there have been some dealings in basic acid billets from stock at hardening prices. There has been some inquiry for wire rods, but supplies are nearing exhaustion. Generally, steel production is now suspended, but here and there melting continues on a small scale. With the virtual exhaustion of supplies of open-hearth steel, the production of heavy forgings, axles and tyres is coming to an end. Heavy steel orders are being suspended, and a certain amount of business which would have been placed in Sheffield has been diverted to the Continent, although at present the volume is not considerable. There is practically no change in the condition of the tinplate market, which is rather quiet. The number of mills working has not been increased, and the output continues low. The demand for stock plates is weaker, but prices are steady.

Scrap.

Conditions in the various markets for scrap metals continue depressed, but in the Midlands there is still a fair demand for cast-iron material, partly caused, of course, by the shortage of pig-iron. Various prices are being offered depending upon the quality of the material. For the best quality heavy machinery cast-iron scrap in cupola sizes 75s. per ton delivered to the local foundries is the usual figure. Good heavy cast-iron scrap, not necessarily all machinery, is being sold at 2s. 6d. to 5s. per ton less. There is not such a good demand for light cast iron as the heavier qualities, but 60s. to 62s. 6d. has been offered in several directions.

Metals.

Copper.—The stronger position recently noted in the market for standard copper is fully maintained, and, in fact, values have further advanced. A point which has added considerable strength to the position is that, on the slightest sign of liquidations, buyers have been showing remarkable keenness to absorb the metal. Sentiment has not only improved in consequence of the heavy consumption of the metal in America, but also owing to the fact that European buying is more prominent, particularly on German account. It seems pretty obvious now that, when the new Association comes into operation, very considerable support will be accorded to values.

Official closing prices of standard copper have been as follow:—

Cash: Thursday, £58 17s. 6d. to £59; Friday, £59 to £59 2s. 6d.; Tuesday, £59 5s. to £59 7s. 6d.; Wednesday, £59 5s. to £59 7s. 6d.

Three Months: Thursday, £59 12s. 6d. to £59 15s.; Friday, £59 15s. to £59 17s. 6d.; Tuesday, £60 to £60 2s. 6d.; Wednesday, £60 2s. 6d. to £60 5s.

Tin.—Speculative interest in standard cash tin is becoming very active at the moment, and values have spurted to a remarkable extent during the last week or so. Heavy consumption in America and Europe has also been responsible for added strength, and altogether it appears as if a heavy bull account is accumulating. This will no doubt be watched very carefully, notwithstanding the fact that the soundness of the statistical position permits of adverse circumstances without undue effect on the market.

Official closing prices of standard tin have been as under:—

Cash: Thursday, £291 10s. to £291 15s.; Friday, £291 12s. 6d. to £291 17s. 6d.; Tuesday, £294 10s. to £294 15s.; Wednesday, £296 5s. to £296 10s.

Three Months: Thursday, £286 5s. to £286 10s.; Friday, £286 10s. to £286 15s.; Tuesday, £288 5s. to £288 10s.; Wednesday, £289 5s. to £289 10s.

Spelter.—The movement in ordinary spelter has not been so pronounced, but the metal is nevertheless very firm, and when declines in values have been recorded, they have been more or less insignificant. Reports received from America are encouraging, and buying on the Continent has also been good, which has offset the disastrous effects of the industrial shutdown in this country.

The following are the week's prices:—

Ordinary: Thursday, £34 7s. 6d.; Friday, £34; Tuesday, £33 18s. 9d.; Wednesday, £34.

Lead.—A fortnight ago there was a reaction in values of soft foreign pig, which was hailed with satisfaction in some quarters, which professed not to be able to balance the statistical situation with the earlier strength of the market. The fall, however, has since been recovered, largely due to increased Continental buying, partly on consumption account and partly professional, which has improved the statistical position correspondingly.

The week's prices are appended:—

Soft foreign (prompt): Thursday, £33; Friday, £33 5s.; Tuesday, £33 5s.; Wednesday, £33 2s. 6d.

THE COUNCIL of the Institution of Electrical Engineers has made the following award of premiums for Papers read during the session 1925-26, or accepted for publication:—The Institution premium to Mr. L. C. Grant (Newcastle-on-Tyne); Ayrton premium to Mr. S. Mayor (Glasgow); Fahie premium to Messrs. B. S. Cohen (London), A. J. Aldridge (Northwood, Essex), and W. West, B.A. (London); John Hopkinson premium to Mr. S. Ferguson (Manchester); Kelvin premium to Mr. P. Dunsheath, M.A., B.Sc. (Gravesend); Paris premium to Mr. T. Carter (Newcastle-on-Tyne); extra premiums to Professor S. P. Smith, D.Sc. (Glasgow), Messrs. J. L. Thompson, M.Sc. (Manchester), H. Walmsley (Manchester), and Dr. A. B. Wood (Teddington).

"SERVICE GRC FIRST"

TO THE FOUNDRY TRADE,
WHETHER SHIVERING BY THE SEA,
OR SWELTERING IN THE FOUNDRY,
(OR VICE VERSA)—

THE SANDS ARE RUNNING OUT

AND

VERY SOON THERE WILL BE
PLENTY OF COAL & COKE!

IN THE MEANTIME, THE SANDS OF THE

GENERAL REFRACTORIES CO., LTD.,
SHEFFIELD

ARE NOT RUNNING OUT

and they are in a position to execute all orders of Core and Moulding Sands with promptitude—also Refractories of every kind.

BCM/OK9
LONDON.

No need to try and remember our name in case it is unfamiliar to you. This is our British Monomark. Envelopes addressed simply thus will be delivered to us by arrangement with the G.P.O.

THE FOUNDRY TRADES EQUIPMENT & SUPPLIES ASSOCIATION LTD.

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash ..	59	5	0
Three months ..	60	2	6
Electrolytic	67	5	0
Tough	64	10	0
Best selected ..	65	0	0
Sheets	90	0	0
India	74	0	0
Wire bars	67	15	0
Do. August ..	67	10	0
Do. Sept.	67	10	0
Ingot bars	67	0	0
H.C. wire rods ..	71	10	6
Off. av. cash, July	57	18	6 3/11
Do., 3 mths. July	58	13	11 8/11
Do., Sttlmnt, July	57	17	11 3/11
Do., Electro, July	65	17	0 8/11
Do., B.S., July ..	64	0	10
Aver. spot price copper, July ..	57	17	11½
Do., wire bars, July	66	1	7
Solid drawn tubes		12½d.	
Brazed tubes ..		12½d.	
Wire		9½d.	

BRASS.

Solid drawn tubes ..	11½d.
Brazed tubes	13½d.
Rods, drawn	11½d.
Rods, extd. or rlld. ..	7½d.
Sheets to 10 w.g ..	10½d.
Wire	10½d.
Rolled metal	9½d.
Yellow metal rods ..	7½d.
Do. 4 × 4 Squares	8d.
Do. 4 × 3 Sheets ..	8½d.

TIN.

	£	s.	d.
Standard cash ..	296	5	0
Three months ..	289	5	0
English	294	15	0
Bars	296	0	0
Straits	303	0	0
Australian		—	
Eastern	292	10	0
Banca		—	
Off.avr. cash, July	282	3	11 1/22
Do.,3 mths., July	280	5	9 6/11
Do., Sttlmt. July	282	2	11 5/11
Aver. spot., July	282	3	11

SPELTER.

	£	s.	d.
Ordinary	34	0	0
Remelted	33	5	0
Hard	29	0	0
Electro 99.9 ..	37	12	6
English	35	0	0
India	31	5	0
Zinc dust	43	0	0
Zinc ashes	16	0	0
Off. aver., July	34	3	1 27/44
Aver., spot, July	33	0	11

LEAD.

	£	s.	d.
Soft foreign ppt.	33	2	6
English	34	10	0
Off. average, July	31	12	7 4/11
Average spot, July	31	14	3½

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	42	0	0
Do. V.M. ex whf.	39	10	0
Rods	44	0	0
Boiler plates ..	38	10	0
Battery plates ..	38	0	0

ANTIMONY.

	£	s.	d.
Special brands, Eng.	74	10	0
Chinese	61	0	0
Crude	40	0	0

QUICKSILVER.

	£	s.	d.
Quicksilver ..	15	5	0

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon	
25%	9 0 0
45/50%	11 0 0
75%..	18 5 0
Ferro-vanadium—	
35/40% ..	15/- lb. va.
Ferro-molybdenum—	
70/75% c. free ..	5/9 lb.
Ferro-titanium—	
23/25 carbonless	11½d.
Ferro-phosphorus, 20/25%,	£17 0 0
Ferro-tungsten—	
80/85%,c.fr. ..	1/4½ lb.
Tungsten metal powder—	
98/99% ..	1/10½ lb.
Ferro-chrome—	
2/4% car. ..	£33 10 0
4/6% car. ..	£22 0 0
6/8% car. ..	£21 10 0
8/10% car. ..	£20 15 0
Ferro-chrome—	
Max. 2% car.	£37 0 0
Max. 1% car.	£43 10 0
Max.0.70%car.	£54 10 0
70%,carbonless	1/5½ lb.
Nickel—99%, cubes or pellets ..	£170
Cobalt metal—98/99%	10/- lb.
Aluminium 98/99%	£118
Metallic Chromium—	
96/98% ..	3/3 lb.
Ferro-manganese (net)—	
76/80%, loose	£15 0 0
76/80%, packed	£16 0 0
76/80%, export	£14 5 0
Metallic manganese—	
94/96%, carbonless	2/- lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten ..	s. d. 2 6
Finished bars, 18% tungsten ..	3 0

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares 3 in. and over .. 4d.lb.

Rounds and squares under ½ in. to ¼ in. 3d. lb.

Do. under ¼in. to ⅛ in. .. .. 1/- lb.

Flats, ½in. × ¼in. to under 1 in. × ¾ in. 3d. lb.

Do. under ¼in. × ¼in. 1/- lb

Bevels of approved sizes and sections 6d. lb.

Bars cut to length 10% extra

Scrap from high-speed tool steel—

Scrap pieces .. .. 3d.

Turnings and swarf 1d.

Per lb. net, d/d steel makers' works.

SCRAP.

	£	s.	d.	£	s.	d.
South Wales—						
Hvy. steel	2	10	0	to 2	17	6
Bundled steel & shrngs.	2	0	0	to 2	5	0
Mixed iron & steel ..	2	0	0	to 2	5	0
Heavy cast iron	3	0	0			
Good machinery for foundries ..	3	5	0			
Cleveland—						
Heavy steel ..	3	1	0			
Steel turnings ..	2	6	0			
Cast iron borings	2	5	0			
Heavy forge ..	4	2	6			
Bushelled scrap	3	10	0			
Cast-iron scrap	3	8	6	to 3	10	0
Lancashire—						
Cast-iron scrap	3	2	6	to 3	10	0
Hvy. wrought ..	3	2	6			
Steel turnings ..	2	2	0			

London — Merchants' buying prices delivered yard.

Copper (clean)..	48	0	0
Brass (clean) ..	39	0	0
Lead (less usual draft)	28	0	0
Tea lead ..	24	0	0
Zinc	23	0	0
New aluminium cuttings ..	80	0	0
Brazierv copper	44	0	0
Gunmetal ..	45	0	0
Hollow pewter	190	0	0
Shaped black pewter ..	138	0	0

PIG-IRON.

(*f.o.t. unless otherwise stated*).

N.E. Coast—	
Foundry No. 1 ..	92/6
Foundry No. 3 ..	90/-
Foundry No. 4 ..	89/-
Forge No. 4	88/6
Hematite No. 1 ..	81/6
Hematite M/Nos. ..	81/-
N.W. Coast—	
Hem. M/Nos. d/d Glas.	87/6
„ d/d Birm.	98/9
Midlands—	
Staffs common* ..	—
„ No. 4 forge ..	—
„ No. 3 foundry	—
Shrops. basic	—
„ Cold blast, ord.*	—
„ „ roll iron* ..	—
* d/d Birmingham.	
Northants forge	—
„ fdry No. 3 ..	—
Derbyshire forge ..	—
„ fdry. No. 3 ..	—
„ basic	—
Scotland—	
Foundry No. 1 ..	—
„ No. 3 ..	84/3
Hem. M/Nos.	79/-
Sheffield (d/d district)—	
Derby forge	—
„ fdry. No. 3 ..	—
Lincs. forge	—
„ fdry. No. 3 ..	—
E.C. hematite	93/-
W.C. hematite ..	90/6
Lincs. (at furnaces)—	
Forge No. 4	—
Foundry No. 3.. ..	—
Basic	—
Lancashire (d/d eq. Man.)—	
Derby forge	—
„ fdry. No. 3 ..	—
Northants foundry No. 3	—
Dalzell, No. 3	110/-
Summerlee, No. 3 ..	102/6
Glengarnock, No. 3 ..	102/6
Gartsherrie, No. 3 ..	102/6
Monkland No. 3	102/6
Coltness, No. 3	102/6
Shotts, No. 3	102/6

FINISHED IRON & STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.	£	s.	d.
Bars(cr.)	11	5	0	to 12	0	0
Angles				11	10	0
Tees to 3 united ins.				12	0	0
Nut and bolt	10	5	0	to 10	7	6
Hoops	14	0	0	to 15	0	0
Marked bars (Staffs.) f.o.t. ..				14	0	0
Gas strip				12	10	0
Bolts and nuts ¾ in. × 4 in. ..				15	5	0
Steel—						
Ship plates				8	2	6
Boiler plts. ..				11	5	0
Chequer plts. ..				9	10	0
Angles				7	7	6
Tees				8	7	6
Joists				7	7	6
Rounds and Squares 3 in. to 5½ ins. ..				8	10	0
Rounds under 3 in. to ¾ in.				8	5	0
Flats, over 5 in. wide and up ..				9	0	0
Flats, 5in. to 1¼in.				8	0	0
Rails, heavy ..				8	0	0
Fishplates				12	0	0
Hoops (Staffs.) ..				10	10	0
Black sheets, 24g.				11	2	6
Galv. cor. sheets, 24g.				17	0	0
Galv. fencing wire 8g. plain				12	10	0
Billets, soft ..				6	10	0
Billets, hard ..				8	2	6
Sheet bars				6	5	0
Tin bars d/d ..				6	5	0

PHOSPHOR BRONZE.

	Per lb.	basis.
Strip	1	3
Sheet to w.g.	1	3½
Wire	1	3½
Rods	1	3
Tubes	1	8
Castings	1	2

Delivery 3 cwt. free

10% phos. cop. £40 above B.S.

15% phos. cop. £50 above B.S.

Phosphor tin (5%) £30 above price of English ingots.

C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	9d. to 1/3
Rolled—	
To 9 in. wide	1/3 to 1/9
To 12 in. wide	1/3½ to 1/9½
To 15 in. wide	1/3½ to 1/9½
To 18 in. wide	1/4 to 1/10
To 21 in. wide	1/4½ to 1/10½
To 25 in. wide	1/5 to 1/11
Ingots for spoons and forks ..	9d. to 1/5½
Ingots rolled to spoon size ..	1/- to 1/8½
Wire round—	
3/0 to 10 G.	1/6½ to 2/1½

with extras according to gauge.

AMERICAN IRON & STEEL.

At Pittsburgh unless otherwise stated.	Dols.
No. 2X foundry, Phila.	22.26
No. 2 foundry, Valley	19.76
No. 2 foundry, Birm.	21.00
Basic	19.51
Bessemer	20.26
Malleable	19.51
Grey forge	19.01
Ferro-mang. 80% d/d	88.00
Bess. rails, h'y, at mill	43.00
O.-h. rails, h'y at mill	43.00
Bess billets	35.00
O.-h. billets	35.00
O.-h. sheet bars ..	36.00
Wire rods	45.00
	Cents.
Iron bars, Phila. ..	2.22
Steel bars	2.00
Tank plates	1.90
Beams, etc.	2.00
Skelp, grooved steel ..	1.90
Skelp, sheared steel ..	1.90
Steel hoops	2.50
Sheets, black, No. 28..	3.10
Sheets, galv., No. 28 ..	4.25
Sheets, blue an'l'd, 9 & 10	2.30
Wire nails	2.65
Plain wire	2.50
Barbed wire, galv. ..	3.35
Tinplate, 100 lb box	$5.50

COKE (at ovens).

Welsh foundry	—
„ furnace	—
Durham & North.	
„ foundry	—
„ furnace	42/6
Other Districts, foundry	—
„ „ furnace (basis)	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. Cokes,	20×14, box	25/-
„	28×20, „	50/-
„	20×10, „	—
„	18¾×14, „	—
C.W.	20×14, „	21/6
„	28×20, „	—
„	20×10, „	—
„	18¾×14, „	—

Terneplates 28×20, — per box basis f.o.b.

SWEDISH IRON.

Bars,hammered	£18/10 to £19/0
Rolled Ord.	£15/10/0 to £16
Nail rods	£16 5 0 to £16 15 0
Keg. steel nom.	£33 to £35
Faggot steel nom.	£22 to £25
Blooms, according to quality	£9 to £12
Pig-iron	£6 5 0 to £7 0 0

all f.o.b. Gothenburg.

TUBES AND FITTINGS.

Up to and incl. 6 in.

	Tubes	*Fittings*
Gas	60%	50%
Water	55%	45%
Steam	50%	40%

W.I. 10% extra.

DAILY FLUCTUATIONS.

Standard Copper (Cash).

		£	s.	d.		
July	29	58	17	6	inc.	7/6
,,	30	59	0	0	,,	2/6
Aug.	3	59	5	0	,,	5/-
,,	4	59	5	0	No change	

Electrolytic Copper.

		£	s.	d.		
July	29	67	0	0	inc.	15/-
,,	30	67	0	0	No change	
Aug.	3	67	5	0	inc.	5/-
,,	4	67	5	0	No change	

Standard Tin (Cash).

		£	s.	d.		
July	29	291	10	0	inc.	32/6
,,	30	291	12	6	,,	2/6
Aug.	3	294	10	0	,,	57/6
,,	4	296	5	0	,,	35/-

Tin (English ingots).

		£	s.	d.		
July	29	290	10	0	No change	
,,	30	290	0	0	dec.	10/-
Aug.	3	293	0	0	inc	60/-
,,	4	294	15	0	,,	35/-

Zinc Sheets (English).

		£	s.	d.		
July	29	42	0	0	No change	
,,	30	42	0	0	,,	,,
Aug.	3	42	0	0	,,	,,
,,	4	42	0	0	,,	,,

Spelter (ordinary).

		£	s.	d.		
July	29	34	7	6	dec.	1/3
,,	30	34	0	0	,,	7/6
Aug.	3	33	18	9	,,	1/3
,,	4	34	0	0	inc.	1/3

Lead (English).

		£	s.	d.		
July	29	34	5	0	No change	
,,	30	34	10	0	inc.	5/-
Aug.	3	34	10	0	No change	
,,	4	34	10	0	,,	,,

AVERAGE MONTHLY PRICES OF STEEL BOILER PLATES IN ENGLAND.

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1895	5 15 0	5 15 0	5 12 6	5 12 6	5 15 0	5 17 6	5 15 0	5 17 6	6 0 0	6 0 0	6 2 6	6 0 0	5 16 10½
1896	6 0 0	6 0 0	6 2 6	6 2 6	6 2 6	6 0 0	6 0 0	6 0 0	6 0 0	6 2 6	6 10 0	6 10 0	6 2 6
1897	6 10 0	6 10 0	6 10 0	6 7 6	6 2 6	6 2 6	6 5 0	6 0 0	6 0 0	6 0 0	6 7 6	6 10 0	6 5 5
1898	6 10 0	6 8 9	6 8 9	6 10 0	6 15 0	6 18 9	6 17 6	6 17 6	7 2 6	6 15 0	7 0 0	7 5 0	6 15 8½
1899	7 5 0	8 0 0	8 2 6	8 2 6	8 5 0	8 5 0	8 12 6	8 12 6	8 15 0	8 15 0	9 2 6	9 5 0	8 17 8½
1900	9 5 0	9 5 0	9 7 6	9 10 0	9 12 6	10 5 0	10 5 0	10 5 0	10 5 0	10 0 0	9 15 0	9 15 0	9 15 10
1901	9 5 0	9 5 0	8 15 0	8 10 0	8 10 0	7 10 0	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	8 3 11
1902	7 7 6	7 0 0	7 12 6	7 12 6	7 12 6	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 9 7
1903	7 10 0	7 10 0	7 15 0	7 5 0	7 5 0	7 5 0	7 5 0	7 0 0	7 0 0	7 0 0	7 0 0	6 17 6	7 3 11½
1904	6 12 6	6 15 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	6 18 11½
1905	6 17 6	6 17 6	6 17 6	6 17 6	6 17 6	6 17 6	6 17 6	6 17 6	6 10 0	7 5 0	8 0 0	8 0 0	7 1 3
1906	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 10 0	8 0 10
1907	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 0 0	8 0 0	8 8 4
1908	7 10 0	7 10 0	7 10 0	7 5 0	7 5 0	7 5 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 3 9
1909	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	6 15 0	6 15 0	6 15 0	7 0 0	7 0 0	7 0 0	7 0 0	6 18 9
1910	7 0 0	7 0 0	7 1 3	7 5 0	7 5 0	7 5 0	7 5 0	7 5 0	7 5 0	7 10 0	7 10 0	7 10 0	7 5 1
1911	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 14 0	7 10 4
1912	7 18 9	8 0 0	8 0 0	8 7 6	8 10 0	8 10 0	8 10 0	8 15 0	8 16 3	9 0 0	9 2 0	9 5 0	8 11 2½
1913	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	8 19 0	8 15 0	8 5 0	7 15 0	7 15 0	8 17 0
1914	7 15 0	7 15 0	7 15 0	7 13 9	7 10 6	7 5 0	7 0 0	8 0 0	8 2 6	8 5 0	8 5 0	8 5 0	7 15 11½
1915	8 14 0	9 10 0	9 17 6	10 10 0	10 10 0	11 0 0	11 0 0	11 0 0	11 0 0	11 4 0	12 0 0	13 0 0	10 15 5½
1916	13 0 0	13 0 0	13 0 0	12 15 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 12 11
1917	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0
1918	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0
1919	13 0 0	15 0 0	15 0 0	15 0 0	19 5 0	19 17 6	21 0 0	21 10 0	21 10 0	21 10 0	21 15 0	23 10 0	18 9 9
1920	26 0 0	28 0 0	28 5 0	28 10 0	29 5 0	30 0 0	30 0 0	30 0 0	30 10 0	31 0 0	31 0 0	31 0 0	29 9 2
1921	30 5 0	29 0 0	25 0 0	25 0 0	25 0 0	23 0 0	21 0 0	20 10 0	19 0 0	17 10 0	16 0 0	14 16 0	22 1 9
1922	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	13 1 8	13 10 0	12 15 0	12 10 0	12 10 0	12 10 0	12 6 0	13 10 9
1923	12 8 9	13 6 0	14 0 0	14 0 0	14 0 0	14 0 0	13 12 6	13 0 0	13 0 0	13 0 0	13 0 0	13 10 0	13 9 1½
1924	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	14 0 0	14 0 0	13 11 0	13 5 0	13 5 0	13 10 11
1925	13 5 0	13 5 0	13 5 0	13 1 0	12 15 0	12 15 0	12 15 0	12 15 0	12 7 6	11 14 0	11 10 0	11 10 0	12 11 5½
1926	11 10 0	11 10 0	11 10 0	11 5 0	11 5 0	11 5 0	11 5 0	—	—	—	—	—	—

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